

*IPM: Innovation Process Model;
Progression in Opportunity
Recognition, Value Co-Creation and
New Business Management*

**I
P
M**

Improvement of Ideation Inducement

Professional Probing Procedure

Multidimensional Mind-Expanding Manual

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Master Thesis
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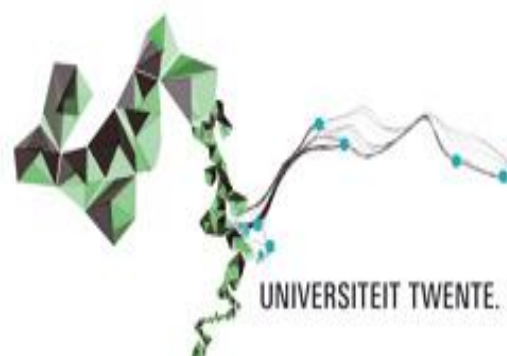
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“Information is a source of learning. But unless it is organized, processed, and available to the right people in a format for decision making, it is a burden, not a benefit.”

- William Pollard-

Management Summary

The problem this study focuses on is ad hoc opportunity recognition process within the sBU Salt Specialties of the corporation of AkzoNobel. This adhocracy limits the success of opportunity recognition, value co-creation and the creation of new business.

The research is characterized as a design study, providing AkzoNobel with an Innovation Process Model (IPM). The IPM is a structured process that consists of internal and external sources of knowledge which enhances the absorptive capacity of the organization. Amplification of the absorptive capacity of the sBU Salt Specialties results in a better process of opportunity recognition, value co-creation and the creation of new business. The IPM is designed for individuals and teams, because they are the starting point of innovations within every organization. The IPM has been implemented for the products of Sanal Salt in the automotive and the metallurgy industry. This resulted in a set of conclusions, limitations and recommendations for the management of Salt Specialties. These findings entail several ways for the organization and its management to optimize control in the process of opportunity recognition, value co-creation and at long last new business creation.

Major recommendations for the short term include gathering additional knowledge of the markets of sodium chloride piston rings and other applications for sodium chloride in metallurgy and automotive industries. Besides knowledge of markets, gathering additional knowledge of customers' needs and ways to serve customers in the piston and metallurgy industry is very important. Applying extra absorptive capacity generated from reading newspapers, magazines and trade press about the automotive and metallurgy industry helps understanding these new focus areas. Likewise conferences, conventions and internet communities should be used. Furthermore mentors can be found in other parts of the organization of AkzoNobel. Possible mentors are located in Business Units of Automotive and Aerospace Coatings, who are able to additional information about the automotive industry.

Serious recommendations for the middle term include starting to use a Community of Practice (CoP). A CoP for the sBU Salt Specialties helps recognizing and identifying new opportunities. A global network of experts and practitioners, sharing knowledge and expertise in order to achieve strategic advantage by creating added value and innovations across the sBU Salt Specialties is a big step forward. Next to the CoP an idea bank improves the ideation process. The sBU Salt Specialties needs a storage system for new ideas, which is easy accessible for every employee within the organization. Idea banks support innovative working behavior and nurture an organization's culture of innovation. Another important middle term recommendation consists of publishing in newspapers, magazine and trade press about Sanal Salt as a product and about its product specific characteristics. Publication leads to new opportunities and value co-creation, because other organizations are able to integrate their absorptive capacity with the technology underlying Sanal Salt, hence open innovation can occur. Furthermore the maintenance of short term recommendations must be handled with care and even further expanded. For instance not only a network of mentors should be formed within the organization of AkzoNobel, but also outside the organization. External mentors are teachers or colleagues who supply additional experience and knowledge of the automotive and metallurgy industry. This results in extra absorptive capacity for individuals and / or teams. As well as mentors, workshops and trainings are excellent ways to generate new ideas and they also expand the absorptive capacity. Another external source of knowledge that can be used to identify new opportunities is collaboration with universities.

Considerable recommendations for the long term consist of maintaining general industry knowledge and information of industry networks of the automotive and metallurgy industry. Industries and networks continuously change and adapt to their environments and new technologies. The only way to stay up-to-date is to be active in these arenas. Communication and sharing of information and knowledge is therefore crucial.

So to conclude, the IPM is an Innovation Process Model that helps individuals and teams to structure the process of recognizing new opportunities, co-created value and in the end creation of new business. These new opportunities consist of new technology applications for the organization of AkzoNobel and specifically for the sBU of Salt Specialties concerning the product of Sanal Salt in automotive and metallurgy industry. The IPM addresses the problem of ad hoc opportunity recognition, because it is structured process that helps to identify new opportunities.

Last but not least, applying the IPM has short-term, middle-term and long-term implications for the organization and its policies. The research design has led to valuable information and knowledge sources for the corporation of AkzoNobel and especially for the sBU Salt Specialties. A general point of attention for the recommendations is that most of the recommendations are also applicable for other applications of Sanal Salt, for instance pharmaceutical, healthcare and food applications.

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1. Introduction

The Global economic crisis causes organizations worldwide to make difficult decisions about divestment and investment issues. Organizations are often forced to make a choice between investment in new opportunities on the one hand and divestment which results in returning to core business on the other hand. This represents in a peculiar way how AkzoNobel handled its investments and divestments of pharmaceutical division and its associated products during the last decade. Typical for the last decade was the divestment of pharmaceutical products. For instance, the division Organon BioSciences was sold by the AkzoNobel Holding to Merck Sharp & Dohme for 11 billion. This is strange, because unlike this divestment there was solid increase of investment in pharmaceutical salt products. In the last couple of years a new investment plan has been activated for pharmaceutical salt of the sub Business Unit (sBU) of Salt Specialties. New and promising products like Sanal Salt P and Sanal Salt SQ are expected to conquer new markets in emerging economies like China, India, Russia and Brazil. Furthermore a search has been started to find new technological applications for Sanal Salt.

This search for new technological applications of Sanal Salt can be seen as a process of opportunity recognition in order to create new value and in the end new markets and new business. The topics of new business development, new product development and opportunity recognition are very common these days in science articles of business management. But this research is almost always carried out on organizational, branch and industry levels, instead of focusing on the individual and team level. This is puzzling, since opportunity recognition is set into motion by individuals and / or teams. A quote of Steve Jobs states the importance of the individual employee and teams in organizations concerning opportunity recognition and value creation.

“Innovation has nothing to do with how many R&D dollars you have. When Apple came up with the Mac, IBM was spending at least 100 times more on R&D. It’s not about money. It’s about the people you have, how you lead them, and how much you get it.”

So in other words individual employees and teams are the starting point of opportunity recognition in organizations. The research that is carried out focuses on the internal and external sources of knowledge of individuals and teams, which are critical for opportunity recognition, value co-creation and the creation of new business, because the ability to recognize an opportunity and to act upon it is crucial for the performance, competitive advantage and survival of organizations.

Currently, the process of opportunity recognition, value co-creation and creation of new business can be described as an adhocracy within the sBU of Salt Specialties. A clear overview about innovation processes concerning internal and external sources of knowledge that can be used to structure opportunity recognition, value co-creation and creation of new business is unknown within the organization.

1.1 Project Framework and Objectives

This research was initiated by the operations director and sales director of the sBU Salt Specialties. The main object of investigation is an Innovation Process Model (IPM) that relates opportunity recognition with value co-creation and the creation of new business on an individual and team level. The focus of this IPM entails the internal and external sources of knowledge which are critical for a structured process of innovation. In the case of the sBU Salt Specialties this means that internal and external sources of knowledge are used for existing and new technologies to identify and create new applications and product concepts. This leads to new value co-creation and in the end also to new business in the form of new market entries and totally new markets. Hence, the main focus of this thesis is about identification of knowledge sources that create new business.

The ability to exploit internal and external knowledge is an important component of innovative capabilities. Evaluating and utilizing these internal and external sources is largely a function of the level of prior related knowledge. This prior knowledge includes basic skills and recent technological and scientific developments in the field. 'Prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm's absorptive capacity', Cohen & Levinthal (1990).

This research is characterized as a design study and provides an Innovation Process Model which is focused on various knowledge sources. During this thesis, the IPM is implemented for Sanal Salt and results in a set of recommendations for the management of Salt Specialties, regarding how the management can be more in control of opportunity recognition, value co-creation and creation of new business on an individual and team level, instead of the ad hoc opportunity recognition that is currently present.

The objective of this research is to design an Innovation Process Model that relates internal and external sources of knowledge which enhance the absorptive capacity of individuals and teams. This absorptive capacity is critical for a structured process of opportunity recognition (new ideas of technology applications), value co-creation (new product concepts) and creation of new business.

The research objective is adequate because (Verschuren & Doorewaard, 2007):

- The Innovation Process Model (IPM) is useful for AkzoNobel, sBU Salt Specialties and the product group of Sanal Salt to recognize opportunities which can result in new business.
- The IPM is realistic; it contributes in better opportunity recognition. Furthermore the IPM stimulates value co-creation and new business creation.
- The research is feasible in technical research perspective and in time.

1.2 Research Questions and Conceptual Research Model

To accomplish the research objective, it is crucial to know what subjects have to be addressed. A research topic can only be addressed with clear research questions. The problem definition consists of a central research question and several sub-questions.

Central Research Question:

- *What Innovation Process Model consisting of internal and external sources of knowledge enhances the absorptive capacity of individuals and teams, which is critical for a structured process of opportunity recognition, value co-creation and the creation of new business?*

In order to get a clear understanding about the central research question, several definitions of core concepts are described in the table on the next page.

Concept	Definition
Innovation Process Model	Internal and external sources of knowledge that together enhance the absorptive capacity of individuals and teams, which is critical for a structured process of opportunity recognition, value co-creation and creation of new business.
Internal Sources of Knowledge	Internal sources are sources that are hard, focused and closely aligned to operational requirements. According to Svetina & Prodan (2008), 'internally, firms acquire knowledge through in-house research and development activities and by learning from continuous improvements in processes.'
External Sources of Knowledge	External sources of knowledge are defined as information external to the organization. According to Svetina & Prodan (2008), external sources of knowledge are accessed if firms do not have appropriate knowledge inside the firm, they can acquire it externally by cooperating with customers and suppliers, as well as other firms, or by forming partnerships with public, semi-public, and private institutions.
Absorptive Capacity	'Prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm's absorptive capacity', (Cohen & Levinthal, 1990).
Opportunity Recognition	Opportunity recognition describes the specific 'eureka' experiences, when suddenly an idea crystallizes. Typically, it is the initial idea which is described as the moment of opportunity recognition (Hills, 1995). Building on these considerations, the process of recognizing opportunities can be defined as efforts to make sense of signals of change (e.g., new information about new conditions) to form beliefs regarding whether or not enacting a course of action to address this change could lead to net benefits, (Shepherd et al. 2007).
Value Co-Creation	Companies need to embrace a new approach to value creation, one in which the basis for value shifts from products to experiences; consumer influence is spread across the value chain (in research and development, design, manufacturing, logistics, service, and points in between); conflicts between companies and consumers are more visible and resolved more productively; and companies don't dictate how value is created (Prahalad & Ramaswamy, 2002). Companies must learn to co-create value with their customers.
Creation of New Business	Creation of new business starts with a business concept. The term business concept is usually defined as an opportunity which has been fully developed to include how specific products will be produced and reach (with benefits) recognized customers (De Koning & Muzyka, 1999).

The central research question is split up into five sub-questions to achieve the research objective, which is to design an IPM that relates internal and external sources of knowledge which enhance the absorptive capacity of individuals and teams. This absorptive capacity is critical for a structured process of opportunity recognition (new ideas of technology applications) value co-creation (new

product concepts) and creation of new business. To achieve this objective, logically the first step is to identify what relationships exist in scientific literature between absorptive capacity and the process of opportunity recognition, value co-creation and the creation of new business. Therefore the first sub-question is:

1. *What is the relationship between absorptive capacity on an individual and team level and the process of opportunity recognition, value co-creation and new business creation according to the literature?*

After the relationship has been clarified between the concept of absorptive capacity and the concepts of opportunity recognition, value co-creation and the creation of new business, a next step in the research has to be applied. This step focuses on a literature review of the internal and external sources of knowledge which form the basis of the concept of absorptive capacity. The following sub-question addresses this second step in research:

2. *Which internal and external sources of knowledge are known in scientific literature that relate to absorptive capacity of individuals and teams?*

When the literature review of the core concepts is finished, a next logical step is to investigate the current situation at AkzoNobel concerning the practices that are used within the organization. These practices focus on the structure of the process of opportunity recognition, value co-creation and creation of new business. The following sub-question can be formulated about this section:

3. *How is the process of opportunity recognition, value co-creation and the creation of new business currently structured within AkzoNobel?*

After the process of opportunity recognition, value co-creation and creation of new business has become clear an in-depth investigation is needed to get clarity about the internal and external sources of knowledge which the corporation AkzoNobel uses and how these relate to the core concept of absorptive capacity. The following sub-question can be formulated:

4. *Which internal and external sources of knowledge that relate to absorptive capacity on an individual and team level are used by AkzoNobel?*

Last but not least the fits and gaps of the core concepts concerning the literature review and practices of AkzoNobel have to be made understandable and visible. Then a synopsis can be derived from theory and practice which results in a definitive Innovation Process Model. The following sub-question addresses this synopsis:

5. *What is the synopsis of internal and external sources of knowledge after comparing the scientific literature and the practices of AkzoNobel?*

To summarize, the first and second sub-question form a theoretical overview of the core concepts that are abstracted from scientific literature. The third and forth sub-question give an overview of the current practices within the corporation of AkzoNobel, which relate to the core concepts of the study. Key empirical data for these sub-questions is extracted from interviews, documents, intranet and internet sources. The fifth sub-question addresses a synopsis between core concepts of scientific literature and practices of AkzoNobel. Together these sub-questions answer

the central research question and support the research objective. A description of the methodology and data collection is given in chapter 4.

Additionally, the sub-questions 6 and 7 address the implementation of the IPM and are not necessary to answer the central research question. These two sub-questions are considered a bonus from the researcher to the corporation of AkzoNobel and specifically to the sBU of Salt Specialties. The bonus consists of actual internal and external sources of knowledge for the sBU Salt Specialties concerning a newly recognized opportunity of Sanal Salt in the automotive and metallurgy industry. The last two sub-questions are:

6. *What are possible new opportunities for Sanal Salt in the automotive and metallurgy industry?*
7. *What resources are recommended to apply the Innovation Process Model?*

Due to the limited research time of this study, the IPM designed in this thesis is only tested for the automotive and metallurgy industries. Thus, the choice is made for an in-depth investigation instead of investigation in width, although the IPM is also applicable for other product applications.

1.3 Relevance and Purpose

This research study is carried out to design an Innovation Process Model that relates internal and external sources of knowledge which enhance the absorptive capacity of individuals and teams. This absorptive capacity is critical for a structured process of opportunity recognition, value co-creation and creation of new business. From a scientific point of view, the design of this model creates valuable and useful knowledge and an overview about opportunities of internal and external sources of knowledge in relation with the concept of absorptive capacity, which results in a structured process of opportunity recognition, value co-creation and creation of new business. This knowledge could also be valuable for other organizations in the private sector as well as in the public sector.

The central research question is formulated as a ‘what question’ and the desired outcome of the research question is how the IPM should be shaped in order to get a structured process of opportunity recognition, value co-creation and the creation of new business.

Thus, the research of this inquiry is of an explorative kind in the form of a design study. This approach fits the central research question, where theory and practices of the corporation of AkzoNobel concerning absorptive capacity, internal and external sources of knowledge are linked with the process of process of opportunity recognition, value co-creation and the creation of new business.

According to Babbie (2007), explorative and design studies are adequate when:

- The research satisfies the researcher’s curiosity and desire for better understanding.
- The research is focused to test the feasibility of undertaking a more extensive study.
- The research is aimed to develop methods to be employed in any subsequent study.

This research is mainly carried out for the second and third reason, since there is a practical reason to carry out this research for AkzoNobel and the sBU of Salt Specialties. Of course the first reason is also applicable for the researcher and the team of pharmaceutical salt since curiosity and a desire for better understanding were the starting point of this study.

Next to the practical relevance of the design of the model, there is also a practical relevance to be found in the validation section of the model. The validation of the model not only displays and explains the Innovation Process Model, the validation also delivers new leads for new applications for the product of Sanal Salt. The research study should also give focus points for future research for the products of Sanal Salt and Innovation Process Model can be used for decision making in future events.

1.4 Research Strategy

The research strategy in this thesis is that of a case study. Advantages of a single case study are (Verschuren en Doorewaard, 2007):

- The in-depth-analysis of the topic, in this case the designing, implementing and evaluating of an Innovation Process Model for AkzoNobel.
- Integrated picture of the research object, advantage for understanding change in an existing situation.
- The value of collecting actual, practical and context sensitive information (Flyvbjerg, 2007).
- The process of research is less structured in advance and thus more maneuverable and more effective when the course of the research needs to be changed. This is an advantage in fast changing environments, like opportunity recognition, value co-creation and the creation of new business.
- Research results are faster accepted by the field experts because of the practical orientation of these results. The internal validity of case studies is excellent. The purpose of most qualitative research and interviews is not generalizing, but generating rich descriptions of their phenomena (Meyer, 2000).

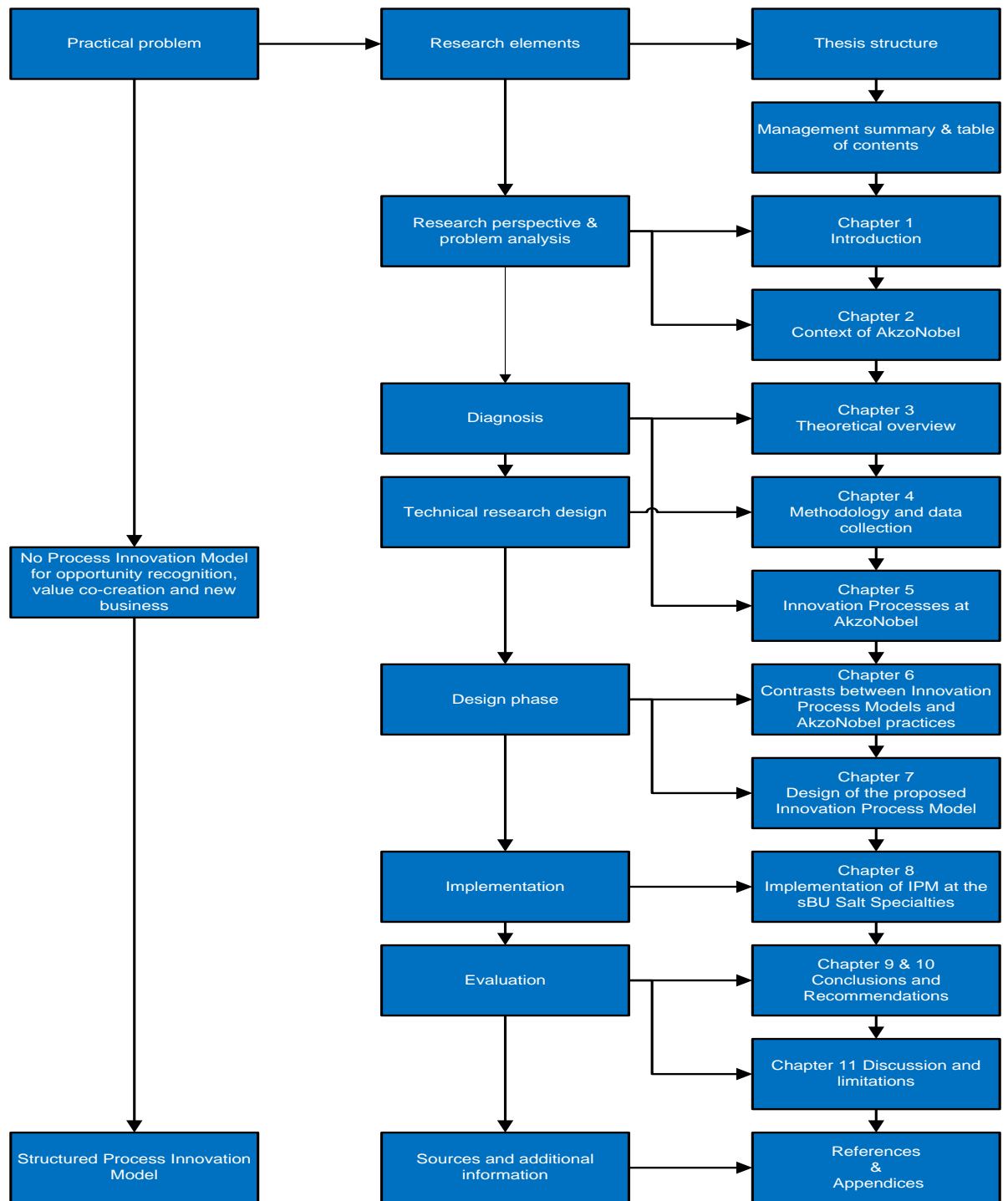
Although the research method that is carried out in this thesis has its advantages, it also has its disadvantages, such as:

- The research method is founded by the use of descriptive information, which is provided by different people. Because the research is in a large part dependent on information people share, essential details can be left out. Furthermore a lot of information that is gathered during the research assignment is retrospective data, which can be subject to problems of memory (Shadish et al., 2002).
- The external validity is a weak point of single case studies; the Innovation Process Model is harder to apply in other corporations than AkzoNobel. This due to specific internal and external sources of knowledge of AkzoNobel, which form the fundament of the IPM.

1.5 Outline of the Thesis

This section displays the general research design and structure of the thesis. The general research design consists of a conceptual part and a technical part. The conceptual part is explained in this chapter and the technical research design, in short the methodology, data collection and data analysis are treated in the chapters 4, 5 and 6.

Figure 1: Overview of Thesis Structure



2. Context of AkzoNobel

This chapter presents corporate information of AkzoNobel, which is useful for readers that are not familiar with the organization.

2.1 History of AkzoNobel

In 1994 the Dutch conglomerate Akzo and the Swedish conglomerate Nobel Industries merged. The roots of Akzo lie in the 18th century when Sikkens, Bemberg and Boldoot were active. The origins of Nobel Industries lie at KemaNobel and Bofors and stems back to the 17th century. Nowadays, AkzoNobel is a worldwide active organization and the biggest on the markets for decorative paints and performance coatings. Furthermore, AkzoNobel is a major producer of basic and specialty chemicals. The head office of AkzoNobel is based in Amsterdam. The revenue in 2011 was 15,697 billion euro's and the net profit was 541 million euro's. AkzoNobel has a total of 57 thousand employees in service.

2.2 The Corporation AkzoNobel

An overview of the organization of AkzoNobel is given in figure 2. The corporation consists of a Board of Management, which is responsible in the day-to-day management of the whole corporation. This board is supported by the corporate staff departments and country staff departments. The corporation AkzoNobel consists of three main business areas, namely Decorative Paints, Performance Coatings and Specialty Chemicals. Proposals are submitted to the following advisory or decision-making bodies in the order set out below:

- Business Unit or Service Unit
- Business Area Board
- Executive Committee (or for some decisions, Board of Management approval will still be required)
- Supervisory Board

Where a body does not have the required authority level, it must refer the proposal to the next level. All proposals that require Executive Committee or Supervisory Board approval must be considered by the relevant Business Area Board first and the relevant corporate staff departments are asked to give advice.

Figure 2: Organizational overview of AkzoNobel



2.3 Organization of Salt Specialties

The business area Specialty Chemicals exists of several main businesses of which one is Functional Chemicals. This main business domain is organized in seven sub Business Units (sBUs): Chelates, Cross Linking Peroxides- Thermoset Chemicals & Polymer Additives (XTP), Ethylene Amines, High Polymer, Performance Additives (Cellulosic Specialties, Elotex), Salt Specialties and Sulfur Derivatives. Salt Specialties is one of the world's major suppliers of sodium chloride. The business is well known for the strong brand names under which the products are sold, such as Jozo®, Nezo®, KNZ®, Sanal®, Suprasel®, Broxo® and Broxomatic®. The sBU Salt Specialties consists of several category groups / markets of which one is Pharmaceutical Salts (Sanal®). Other category groups / markets are Retail, Food, Agriculture, Industrial and Water Treatment. This research assignment will focus on pharmaceutical salt named Sanal Salt. This product is produced in Mariager in Denmark. On the intra-website of AkzoNobel the department of pharmaceutical salt is described as follows:

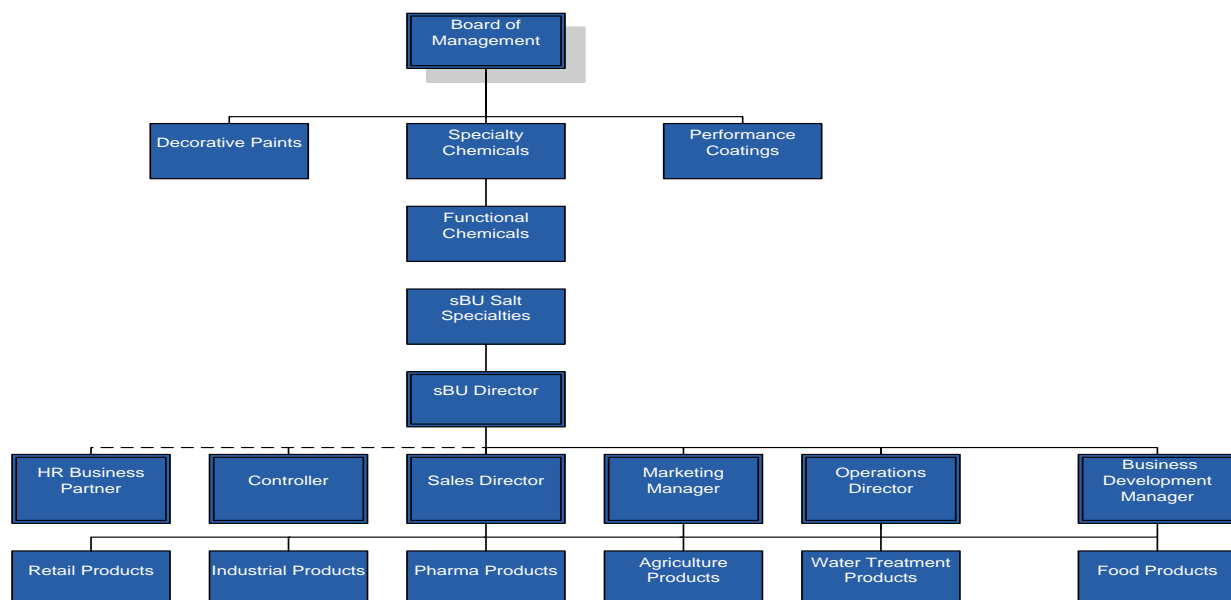
“The purity and quality of the different salt products are of the utmost importance in the pharmaceutical industry. The main market for pharmaceutical salt is the dialysis market. Salt Specialties' pharmaceutical salt product Sanal® P meets the stringent requirements defined by the international pharmacopoeias. Salt Specialties' product quality is considered higher than the competition's thanks to the purity, reduced residues and free-flowing properties of its products. Moreover, Salt Specialties has a unique quality grade Sanal® SQ for which there is no competitive substitution. Both products are sold throughout the whole world.”

In figure 3, on the next page, an integrated overview of the sBU Salt Specialties is given. The responsibility of the growth strategy of Sanal Salt is placed upon the shoulders of the sBU Sales Director. Action points are the following:

1. Increase market knowledge (size, growth rates, competition, substitution of non-pharmaceutical, etc)
2. Expand pharmaceutical production capacity to 60kt in 2012 (Pharmaceutical 2) and 80kt in 2012 (Pharmaceutical 3)
3. Detail out options to significantly expand and accelerate growth of our pharmaceutical business to 180kt or more (Pharmaceutical 4)
4. Focus growth on large developing countries: China, India, Brazil
5. Define innovation plan for pharmaceutical applications
6. Explore potential of alternative applications

The research of this thesis is a part of these action plans, specifically the action plan numbers five and six. This is elaborated in the upcoming chapters of this thesis.

Figure 3: Integrated overview of sBU Salt Specialties in the Organization of AkzoNobel

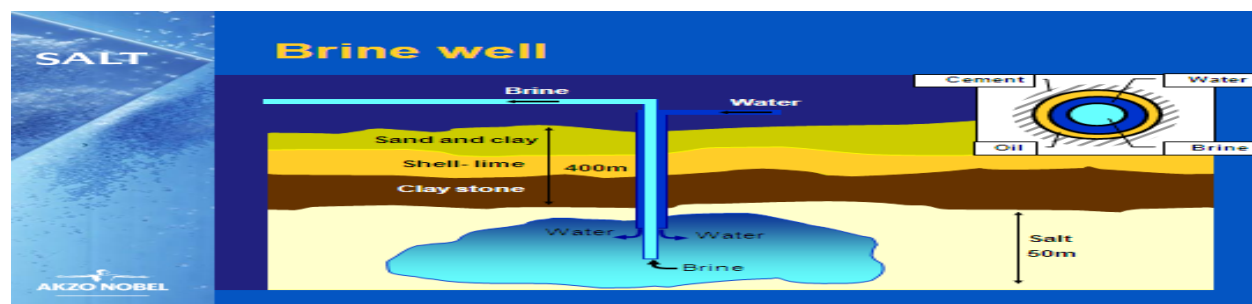


2.4 Pharmaceutical Salt production, Characteristics and Markets

Pharmaceutical Salt Production

There are three main ways of manufacturing sodium chloride. This results in three different sodium chloride types and in quality differences of the obtained salt. The production ways differs dramatically for vacuum salt, rock salt and sea salt. Below the production of vacuum salt is shown in a simplified picture.

Figure 4: Vacuum salt production



In figure 4 a process is displayed where salt dissolves from underground deposits by pumping water into the ground. This results in brine which is pumped up to the surface again. At the surface the brine is transported in pipelines to the factory. In the factory the brine is evaporated in boilers which are operating under pressure or in vacuum. The final result is pure refined salt (vacuum salt). Vacuum salt is the finest and sea salt and per definition vacuum salt refined salt. The type of salt used in the different markets differs from the type of application. In pharmaceutical markets only vacuum salt is used.

Pharmaceutical Salt Characteristics

The pharmaceutical salt of AkzoNobel (Sanal®) is of the highest quality. Sanal is sodium chloride in its purest form without additives. Sanal® P (NaCl content >99.96%) is suitable for the manufacture of parenterals, haemodialysis, haemofiltration, haemodiafiltration and peritoneal dialysis solutions. Sanal® SQ (NaCl content >99.99 %) is suitable for use as fine chemicals pursuant to ACS requirements, microelectronics, micro galvanic processes, haemodialysis, haemofiltration, haemodiafiltration and peritoneal dialysis solutions. Below some characteristics of Sanal Salt are described.

- Extraordinary chemical purity - non-pyrogenic
- Active Pharmaceutical Ingredients (API)
- Sanal® P Sodium Chloride Pharmaceutical Quality, API quality
- Sanal® SQ Sodium Chloride Chemical Pure Quality, API quality
- Sanal® is free-flowing

Another aspect of sodium chloride is its necessity for the human body. Among others, its main functions are:

- Maintaining fluid balance
- Adjusting the rhythm of the heart muscle
- Allowing the transmission of nerve impulses
- Removing excess acidity in cells, especially the brain
- To prevent the appearance of muscle cramps
- To allow the absorption of nutrients in the body
- To regulate sleep
- To maintain the balance of sugar

Next to the specific characteristics of Sanal Salt and the functions of sodium chloride for the human body, sodium chloride in general has certain characteristics that can be useful for identifying new opportunities. These characteristics are:

- Sodium chloride as a chemical is very stable product.
- Sodium chloride is soluble in water.
- Sodium chloride has a melting point of 801°C and a boiling point of 1465 °C.
- At relative humidity > 75 % sodium chloride adsorbs water.
- At relative humidity < 75 % sodium chloride loses water.
- Dry storage (relative humidity < 75 %) of sodium chloride is recommended.
- Large effect of temperature on absorption rate.
- Wetting followed by drying of sodium chloride is cause of caking.
- Migration of water (temperature differences) is important.

Pharmaceutical Salt Markets

Pharmaceutical salt products of AkzoNobel, like Sanal® P and Sanal® SQ can generate sales in several distinctive market types. These market types can be roughly divided into two types, namely:

- Pharmaceutical market
- Non-pharmaceutical market

Pharmaceutical Markets

The pharmaceutical market is a traditional type of market. The markets are known to the organization and the focus is on market penetration and / or product development. An existing market can be a mature market or a growth market. For the products Sanal® P and Sanal® SQ West Europe and the United States can be characterized as mature markets and the countries Brazil, Russia, India and China as growth markets. In these developing countries common working people become richer and can afford dialysis. Also government regulations change in a positive manner in these countries. More money becomes available for healthcare and thus indirect for dialysis. Figure 5 gives an overview of the different options.

Figure 5: Product / market matrix (Ansoff, 1957)



Non-Pharmaceutical Markets

The non-pharmaceutical markets can be divided into food and non-food markets. Food markets for the products Sanal® P and Sanal® SQ are characterized by very demanding and strict government regulations of sodium chloride in food. An example of such a country is Japan. Non-pharmaceutical markets in combination with non-food markets are very difficult to find. The product / market matrix of Ansoff shows that finding these new markets is about market development and / or diversification. The focus of this thesis is to create an Innovation Process Model that helps to identify these new opportunities that can create new business, hence market development and / or diversification.

3. Theoretical Overview of Innovation Process Models

In this chapter the first and second sub-question, which are stated below are addressed. Furthermore descriptions of several theories applicable for these research questions are explained. These theories and models are empirically tested in previous research, are proven to be significant and form the theoretical framework of this thesis.

1. *What is the relationship between absorptive capacity on an individual and team level and the process of opportunity recognition, value co-creation and new business creation according to the literature?*
2. *Which internal and external sources of knowledge are known in literature that relate to absorptive capacity of individuals and teams?*

3.1 Innovation Types and Scopes

Innovation is the basic renewal process in organizations and is a synonym for change. Innovation is crucial for organization. The survival and growth of organizations depends on innovations that are successfully executed (Tidd et. al., 2001). Innovations can be categorized as product innovations and process innovations. The later of these two innovations types is a central concept in this thesis and stands for how the products are created and delivered.

Next to the type of innovation another important factor of innovations has to be mentioned, namely the scope of innovations. The scope of innovations describes the novelty of an innovation, which are continuous and discontinuous innovations. Continuous innovations are improvements regarding established technologies and discontinuous innovations concerns accomplishments, developments and applications of new ideas and technologies (Magnusson et. al., 2003). In short continuous innovations entail incremental change, which generally is handling normal organization actions in a better way. Continuous innovations are often linked with cost based improvements. On the other hand discontinuous innovations entail radical changes, which generally can be stated as handling organization actions in a totally different manner. Discontinuous innovations change markets and sometimes even industries.

For AkzoNobel and especially for the sBU Salt Specialties the process of innovation is important, because the process of opportunity recognition, value co-creation and the creation of new business are not structured very well. The sBU Salt Specialties needs a better process of innovation and this newly designed process focuses on internal and external sources of knowledge. These sources enhance the absorptive capacity of individuals and teams, which should result in continuous and discontinuous innovations for the sBU Salt Specialties. Before an explanation and elaboration of the concept of absorptive capacity is given a closer view is needed concerning the concept of opportunity recognition and the process of opportunity recognition.

3.2 Opportunity Recognition and the Process of Opportunity Development

In the article De Koning and Muzyka (1999), a model of opportunity formation is given, which shows how entrepreneurs create visions for new business. This is important to the sBU of Salt Specialties, especially if the focus is on individuals and teams and how these create a vision for new business and handle opportunity recognition.

The authors ask themselves the following question in the article: “how does the entrepreneur use his social context to recognize opportunity?” This question can easily be translated to the case of AkzoNobel if we change the entrepreneurs for employees within the organization. “The goal of using this article is to propose a new perspective on opportunity recognition, one which places the entrepreneur in his social context and takes into account the time required to developed ideas.” This new perspective is important for managers of the sBU of Salt Specialties and AkzoNobel in general, because research has already recognized that the social context provides information and

resources for the innovator, both entrepreneurs and managers (Starr and Macmillan 1992 and Hensen 1996).

Next to these theoretical insights the article defines the use of the terms opportunity recognition and development. The term opportunity development is described as follows: “Opportunity development best describes the process of opportunity recognition over time.” Currently, researchers use the term opportunity recognition to explain two things.

- First, opportunity recognition describes the specific 'eureka' experiences, when suddenly an idea crystallizes. Typically, it is the initial idea which is described as the moment of opportunity recognition (e.g. Hills, 1995).
- Other researchers use opportunity recognition to describe the evolution of initial ideas into full-blown business concepts (Bhave, 1994). The distinctions are not always clear, leading to confusion.

By using the term opportunity development, the researcher of this thesis addresses Bhave's second definition of opportunity recognition, highlighting the evolutionary process. In fact, opportunity development probably includes several moments of sudden insight or opportunity recognition. For this case study the terms opportunity recognition and opportunity development are used as stated above. The terms of opportunity development and opportunity recognition can be explained by using the model of Bhave.

Figure 6: Process of Opportunity Development (Bhave, 1994)

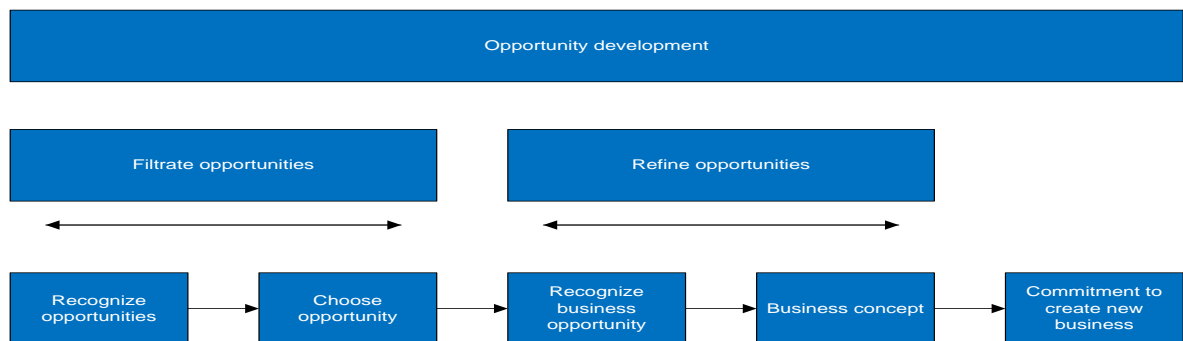


Figure 6 shows that opportunity development generally exists of two phases, which can be elaborated into five sequential steps. The two phases of opportunity development are filtrating and refining opportunities. Filtrating opportunities is mainly about recognizing opportunities. These opportunities are often pulled from needs from market, but it is also possible that a new technology is pushed into the market. Once opportunities are recognized, companies have to chose an opportunity and refine it. This is the transition of phases. Opportunities become more concrete in the form of business concepts, which in the lead to new business.

For AkzoNobel and specifically the sBU Salt Specialties products of Sanal Salt this model can be used to explain the research field of the assignment. Sanal Salt is a unique product with several specific characteristics. Unlike sodium chloride of the competitors, Sanal Salt is free-flowing and still very pure in nature. New opportunities for Sanal Salt can arise in a form of technology push, when looking at the characteristics of the product. But the product Sanal Salt can also be seen as an opportunity which corresponds with market pull strategies. The consequence of this view is that the product can be applied in other markets besides the pharmaceutical market. Both market pull and technology push strategies can create new business opportunities. The description of

opportunity development states the importance of opportunity recognition which can happen multiple times during the development of opportunities.

3.3 Prior Knowledge and Absorptive Capacity

‘Outside sources of knowledge are often critical to the innovation process, whatever the organizational level at which the innovation unit is defined’ (Cohen & Levinthal, 1990). At the organizational level, most innovations result from borrowing ideas instead of inventing new ideas. This is supported by extensive research in the past of for example Mueller (1962), Johnston and Gibbons (1975) and von Hippel (1988).

The ability to exploit internal and external knowledge is an important component of innovative capabilities and the innovation process in general. The ability to evaluate and utilize these internal and external sources is largely a function of the level of prior related knowledge. This prior knowledge includes basic skills and recent technological and scientific developments in the field. Prior knowledge of individuals and groups is very important for opportunity identification processes. The larger the prior knowledge of individuals and groups are, the better the understanding of new information is. According to Von Hippel (1994), people tend to only notice information that is related to information they already know. Differences in prior knowledge cause differences in understanding information, which in the end cause a difference in recognizing opportunities. A larger pool of prior knowledge of individuals results in a larger entrepreneurial alertness. Ardichvili et al. (2003), describe two types of prior knowledge. These are special interest knowledge and task specific knowledge. Special interest knowledge consists of what an individual enjoys in his / her private life. The task specific knowledge consists of the knowledge an individual accumulates in his / her professional life and addresses general industry knowledge. According to Ardichvili et al., task specific knowledge exists of three dimensions, namely;

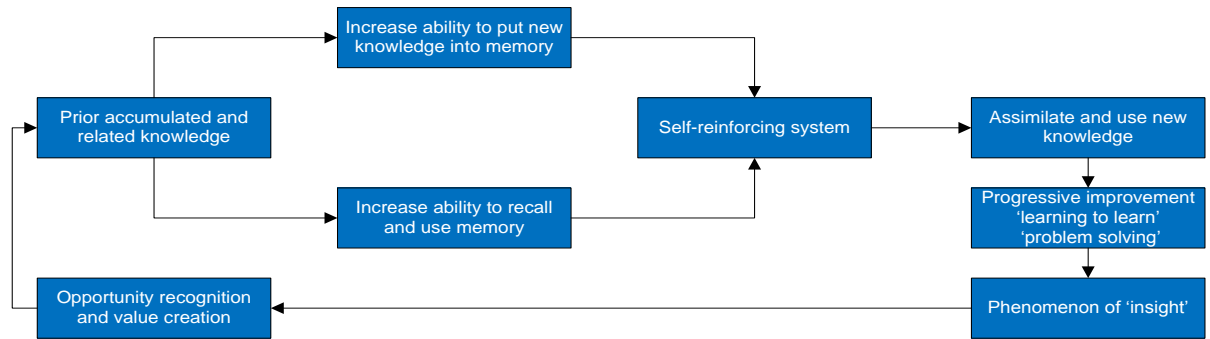
- Prior knowledge of markets
- Prior knowledge of customer problems
- Prior knowledge of ways to serve the customers

The combination of special interest knowledge and task specific knowledge can cause discoveries of new markets, new opportunities and new solutions for customers’ problems. ‘Prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm’s absorptive capacity’ (Cohen & Levinthal, 1990). So in a matter of fact, absorptive capacity of individuals and teams constitute to opportunity recognition and value co-creation. In the case of AkzoNobel this absorptive capacity is very important to stimulate opportunity recognition and value co-creation. A firm like AkzoNobel and a sBU like Salt Specialties should invest in absorptive capacity of individuals and teams. A higher level of absorptive capacity for individuals and teams within the sBU Salt Specialties can be achieved by applying the following activities more often.

- Seminars
- Conferences
- Conventions
- Reading of newspapers, magazines and trade press
- Publishing in newspapers, magazines and trade press

In the figure on the next page an overview of the process of absorptive capacity and prior knowledge is given.

Figure 7: 'Absorptive Capacity and Creative Capacity' under the condition of intensity of effort



To explain the model above an example is used in the form of an individual team member of the sBU of Salt Specialties. Imagine an individual of Salt Specialties with a core task of selling Sanal Salt. The person knows almost everything concerning the products and its uses in the pharmaceutical markets. The person is always up-to-date and well informed about market changes that could happen in the future. One could say that this person has a high level of prior accumulated and related knowledge of the pharmaceutical market and the uses of Sanal Salt in these markets. If something changes in the market, the person can easily recall and use his memory and it is also not hard for the person to put new knowledge into his memory. The use of the memory and learning new things is a self-reinforcing system. This results in easier and faster assimilation and use of new knowledge if the basic knowledge is already of a high level. Changes for example in dialysis methods are better understandable for the person with a high level of prior knowledge than for a person that has a lower level of prior knowledge. The higher level of prior accumulated and related knowledge causes a bigger chance for the person to get a phenomenon of insight. This results in a better chance of opportunity recognition and value co-creation. And because new knowledge has been obtained about dialysis the prior accumulated and related knowledge is on a higher level now. Hence the process is iterative in nature.

But what can be done by the sBU Salt Specialties if the individual person of the example from above needs to explore totally new applications for Sanal Salt? The previous question can be answered by increasing the prior accumulated and related knowledge of the employee related to sodium chloride applications in other markets and industries. The Innovation Process Model, which is designed during this thesis, supports the increase of prior accumulated and related knowledge of sodium chloride applications. In the case of AkzoNobel as corporation and the sBU Salt Specialties, it is important to realize that employees have a lot of available prior accumulated and related knowledge. In the case of Salt Specialties a broad knowledge basis is needed. This broad basis increases the ability to use new knowledge about sodium chloride for new opportunities. Prior knowledge also increases the ability to recall and use the memory of this knowledge. In fact this absorptive capacity is a self-reinforcing system for individuals and teams. Absorptive capacity causes assimilation and use of new knowledge and can cause progressive improvement for AkzoNobel. It results in 'learning to learn' and adequate 'problem solving' and gives insight to employees and teams which finally result in opportunity recognition, value co-creation and new business creation.

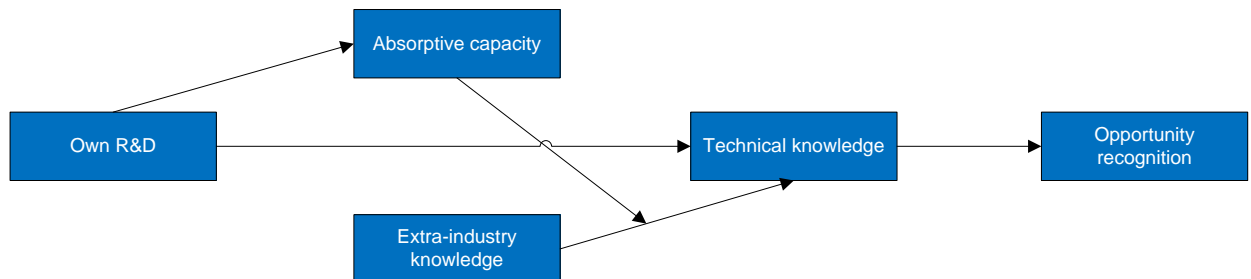
There are several preconditions for the above mentioned process to be successful. Crucial for the process is the intensity of effort by employees and teams. Considerable time and effort should be spent to improve absorptive capacity. Furthermore according to Cohen & Levinthal (1990), learning is cumulative and learning performance is the greatest when the object of learning is related to

what is already known. Also, learning is more difficult in novel domains and more generally an individual's expertise changes only incrementally. Last but not least, diverse backgrounds provide a more robust basis for learning. Hence incoming information can be better related and accumulated. Knowledge diversity facilitates the innovative process.

Absorptive capacity is a key factor for gathering internal and external knowledge. Furthermore absorptive capacity is crucial for a valuable communication process. When there is too much focus on the internal communication and knowledge gathering, individual and team absorptive capacity can cause a 'not-invented-here' syndrome. This means that individuals or teams avoid using or buying already existing products, research, standards or knowledge because of their external origins. As a result the balance between internal and external knowledge gathering is gone. Von Hippel (1988) states that with regards to external relationships, close relationships with both buyers and suppliers are important sources for innovation. The extent to which an organization develops a broad and active network of internal and external relationships, determines the extent to which individuals are aware of other individuals capabilities and knowledge. An active network results in an increase of individual and team absorptive capacity and the absorptive capacity of the organization (Cohen & Levinthal, 1990).

The cumulateness of absorptive capacity suggests an extreme case of path dependence. If an organization in the form of individuals and / or teams ceases to invest in absorptive capacity in a quickly moving field, they may never assimilate and exploit new information in that field, regardless of the value of that information (Chohen & Levinthal, 1990). This phenomenon is called 'lockout'. In the case of AkzoNobel and the sBU of Salt specialties it is important to avoid this 'lockout' phenomenon, because it's an opposite force of opportunity recognition. The greater the expertise and absorptive capacity of individuals and teams, the more sensitive the firm is regarding emerging technological opportunities. An additional effect is that the aspiration level of employees' increases. Furthermore the focus of the individuals and teams is on opportunity recognition rather than strictly on performance measures. Organizations with a higher level of absorptive capacity are more proactive, trying to exploit opportunities which are present in the environment, independent of current performance (Chohen & Levinthal, 1990). In other words an increase of absorptive capacity for individuals and teams enhances the chances of discontinuous innovations. The relationship between absorptive capacities, extra-industry knowledge and opportunity recognition can be viewed in the figure below.

Figure 8: Relationship between Capacities, Extra-Industry Knowledge and Opportunity Recognition (Chohen & Levinthal, 1990)



3.4 Internal and External Sources of Knowledge

Kirzner (1973) developed the entrepreneurial alertness concept which assumes that entrepreneurship involves the discovery of opportunities and the resources to exploit them as the economy moves towards equilibrium. From this perspective, the entrepreneur is an opportunity identifier who has the ability to spot underpriced products or factors of production in particular markets in anticipation of disequilibrium profit opportunities. Thus, Kirzner posited information and information-seeking behavior as the central tenants of entrepreneurial alertness', Busenitz (1996). In order to be as successful as possible in finding new opportunities which lead to new business, employees and teams of the sBU Salt Specialties should have information and information-seeking behavior. This information and information-seeking behavior should then be processed into useful knowledge as is stated in the previous paragraph. Information and information-seeking behavior can be categorized into two distinct types of sources, namely internal and external sources.

- Internal sources are sources that are hard, focused and closely aligned to operational requirements. According to Svetina & Prodan (2008), 'internally, firms acquire knowledge through in-house research and development activities and by learning from continuous improvements in processes'.
- External sources of knowledge are defined as information external to the organization. According to Svetina & Prodan (2008), external sources of knowledge are accessed if firms do not have appropriate knowledge inside the firm. Then they can acquire it externally by cooperating with customers and suppliers, as well as other firms, or by forming partnerships with public, semi-public, and private institutions.

Internal Sources of Knowledge

In a multiunit organization like AkzoNobel, units can learn and benefit from each other by sharing knowledge which is developed by the other units. At a lower organizational level this same conclusion can be drawn for the sBU Salt Specialties and its departments and markets, for instance Sanal Salt. 'Knowledge transfer among organizational units provides opportunities for mutual learning and inter-unit cooperation that stimulate the creation of new knowledge and, at the same time, contribute to organizational units' ability to innovate' (Kogut & Zander, 1992; Tsai & Ghoshal, 1998).

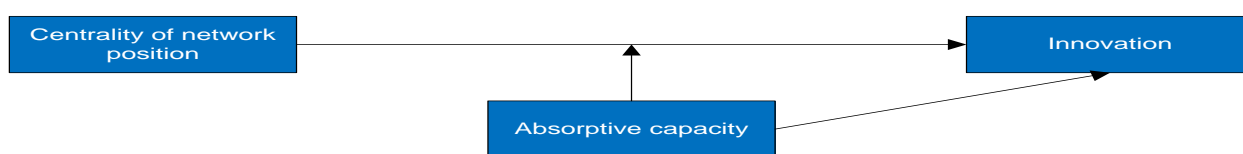
In the case of Salt Specialties and Sanal Salt, the units should be able to learn from knowledge transfer and gain new knowledge, which can help in the opportunity recognition phase. If a unit is able to access knowledge from other units, it also has to have the right amount of absorptive capacity to handle this knowledge to apply it for its own use. The access of knowledge can be improved by obtaining a central network position in an organization. This network consists of inter-unit links and the network is an important part of a learning process in which organizational units discover new opportunities and obtain new knowledge through interacting with one other, in other words innovative ideas are often at the nexus of inter-unit links (Tsai, 2001). The development of inter-unit and individual network links makes knowledge transfer easier and it broadens organizational learning. Important concepts for the effectiveness of inter-unit learning and knowledge transfer are the network position and absorptive capacity (Tsai, 2001). In the article of Tsai, 2001 interesting hypotheses are tested about network positions, absorptive capacity and innovativeness. These hypotheses prove to be significant and are applicable for AkzoNobel in general and specifically for the product group of Sanal Salt, when looking at the team and its individuals. First the hypotheses are described with a short explanation, then a figure is shown with the causal relations and after that the whole figure is explained for Sanal Salt.

The first hypothesis predicts that the centrality of an organizational unit's network position is positively related to its innovation. In other words, a central network position of the sBU Salt Specialties in the business of Functional Chemicals contributes to successful innovation. The same view can be applied for Sanal Salt in the sBU of Salt Specialties.

The second hypothesis of the article predicts that an organizational unit's absorptive capacity is positively related to its innovation output. This means that units with a high level of absorptive capacity are better able to harness new knowledge from other units to help their own innovative activities. This point supports the main issue of the last paragraph.

The third hypothesis is a mix of the first two statements. This hypothesis is about the centrality of an organization unit's network position and that this is more positively related to innovation when the unit has high absorptive capacity than when the unit has low absorptive capacity. In this case absorptive capacity is a moderator in the relation of network position and innovation. 'The better a unit can access other units' knowledge, the more it needs absorptive capacity to benefit from such knowledge.

Figure 9: Effects of Network Position and Absorptive Capacity on Innovation (Tsai, 2001)



In the case of Sanal Salt, it is important to take a central place in the intra-unit network, this results in more accessible knowledge and thus it affects the ability to recognize and respond to new market opportunities. Next to the network centrality of Sanal Salt in the sBU of Salt Specialties it is also very important that the team and individuals have a high level of absorptive capacity. Absorptive capacity results ultimately in better technical knowledge which should be applicable of the Sanal Salt products.

Not only does absorptive capacity directly influence the innovativeness of the product group of Sanal Salt, it also has influence on the relation of the centrality of network position and innovation. As is described above, if a unit is able to access knowledge from other units, it also has to have the right amount of absorptive capacity to handle this knowledge to apply it for its own use.

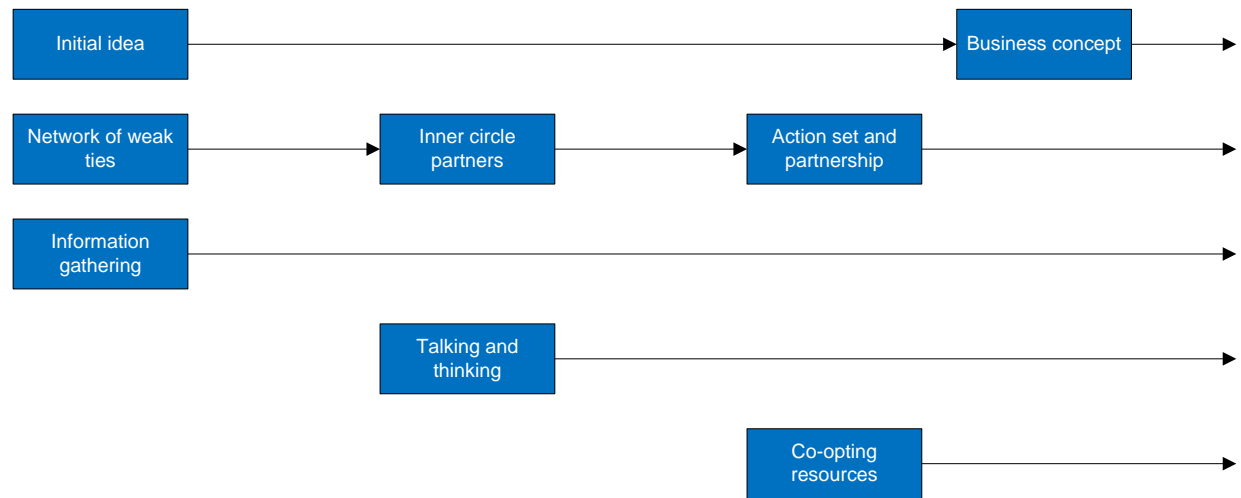
A practical example of this knowledge transfer in intra-organizational networks, with the concepts of absorptive capacity, centrality of network position and innovation for Sanal Salt can be described by the technology of 'Loso OneGrain TM'. This technology has its origin in another department of Salt Specialties, but with the right amount of access to this information (network position) and the right amount know-how assimilation and replication (absorptive capacity), opportunity recognition and value creation (innovation) could be the result of knowledge transfer. Loso OneGrain TM is a technology that makes one grain of multiple minerals and sodium chloride. This way the right amount of all the ingredients is guaranteed in a certain volume. Perhaps this technology can be applied in pharmaceutical applications like it is used at the moment in applications of the food industry.

External Sources of Knowledge

Next to prior knowledge, social networks are very important for the opportunity recognition process. Social networks magnify external sources of knowledge. A social network exists of the following aspects.

- Inner circle
- Action set
- Partnerships
- Weak ties

Figure 10: Cognitive Activities and the use of Social Context over time (Koning & Muzyka, 1999)



The figure above shows an overview of the process opportunity development, the arrows in the right part of the figure point to the concept of new business creation. In the case of the sBU Salt Specialties an initial idea can be a new technological application of pharmaceutical salt or another type of sodium chloride. These ideas are generated in cooperation with networks of weak ties of employees of AkzoNobel. These networks of weak ties create information benefits and a potential pool for future resource providers. The weak ties provide individuals and teams with new ideas which are combined with prior knowledge. Furthermore the phase of initial ideas can be characterized as an information gathering phase. This information gathering phase consists of internal and external sources of knowledge.

After the initial idea gets more concrete, the inner circle of employees and their direct partners get more crucial. The inner circle is defined as the set of people with whom the entrepreneur, or in the case of AkzoNobel employees with new ideas, have a long-term, stable relationship. The inner circle consists of frequency of contact and high openness (Koning & Muzyka, 1999). Normally the inner circle can be characterized as friends, family and colleagues of the individuals and teams. The activities in this phase are mainly thinking and talking, which consist of integrating the information into a business opportunity (filtrating and refining of opportunities, figure 6). This form of social interaction must result in action. Otherwise processes might lack clarity and stagnate.

In the last phase of opportunity development the business concept must become concrete. The action set and partners are crucial in this phase. The action set is defined as those people the entrepreneur or in the case of AkzoNobel recruits to provide necessary elements of resources for

the opportunity. 'People are selected for their usefulness, for example, in providing financial resources, technical competences, knowledge, access to specialized information or legitimacy', (de Koning & Muzyka, 1999). In this phase frequent communication of action set members, more than once a week, is correlated with greater success.

So to summarize, social networks and particularly weak ties are very important for recognizing new opportunities. Social networks are a source of collecting and distributing information. This exchange of information is positively related to entrepreneurial alertness, which may result in opportunity recognition and new business.

Weak ties can be a multitude of different persons. Examples of weak ties are;

- Contacts in the same industry
- Contacts in other business areas, internal and external
- Contacts during workshops
- Contacts during seminars
- Contacts during conferences and conventions
- Contacts at universities
- Contacts on the internet

According to scientific literature, information sources play a crucial role in opportunity recognition. 'To identify opportunities for viable new ventures, entrepreneurs must somehow perceive, gather, interpret and apply information about specific industries, technologies, markets, government policies and other factors', (Ozgen & Baron, 2005). The above mentioned is also applicable for employees and teams at AkzoNobel to identify opportunities for new businesses.

Social sources of opportunity relevant information are:

- Mentors
- Informal industry networks
- Participation in professional forums

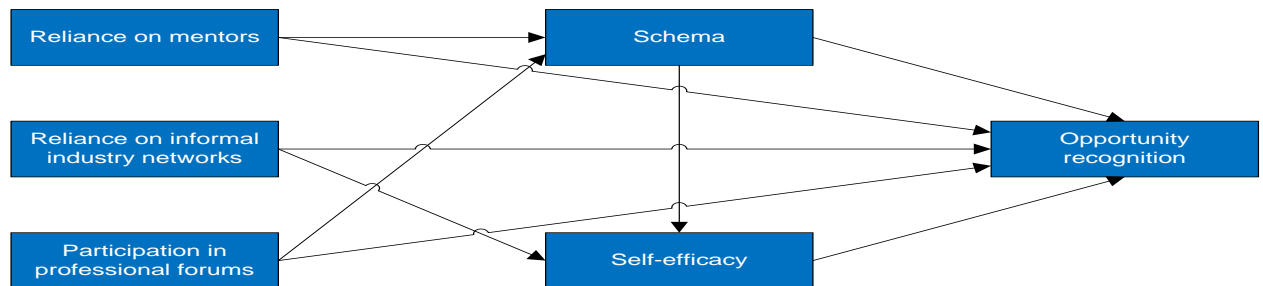
Professional forums exist of conventions, conferences, seminars and workshops. The questions that arise from this information are the following; 'Do these social sources amplify the alertness to new business opportunities and how do AkzoNobel in general and the sBU of Salt Specialties use these sources and what can be learnt from this information?'

'Baron (2004) has suggested that opportunity recognition may also involve cognitive structures possessed by specific persons frameworks for organizing and interpreting information developed through life experience (e.g., schemas, prototypes). Once present, these cognitive frameworks help the persons who possess them to recognize connections between seemingly unrelated events or trends (e.g., connections between changes in technology, markets, demographics, government policies, etc.)', Ozgen and Baron, (2005).

Next to the mediator impact of schemas of individuals and teams on opportunity recognition, the self-efficacy effect is also important. The self-efficacy effect refers to individuals' beliefs that they can successfully accomplish specific tasks that they undertake (Bandura, 1997). According to Ozgen and Baron (2005), persons with high self-efficacy are self assured and relatively confident. Persons with high self-efficacy often have a broader social network and are also often more popular than people who lack in self-assurance. So it seems reasonable to predict that people with a larger social network can obtain more information and this can be linked to identifying more

opportunities. Another effect of high self-efficacy is that people become more proactive in searching for successful or promising opportunities. They are more eager to seek opportunity relevant information from other persons (Gaglio and Katz, 2001). The figure below shows the significant relationships between social sources and opportunity recognition. This figure is explained on the hand of individual employees of the sBU of Salt Specialties.

Figure 11: Relationships between Social Sources and Opportunity Recognition (Baron, 2004)



The figure can be helpful for individual and team recognition of opportunities, if there is a focus on the socially provided information. In the case of AkzoNobel in general and specifically the sBU of Salt Specialties, social sources of information like reliance on mentors, reliance on informal industry networks and the participation in professional forums strengthens opportunity recognition. Reliance on mentors for the sBU of Salt Specialties is important, having a mentor that helps obtaining and interpreting opportunity relevant information, increases opportunity recognition for individuals and teams of the sBU of Salt Specialties.

Furthermore the reliance of mentors strengthens the schemas of individuals and teams, by providing them with extensive experience and additional information. This results in improved opportunity recognition. Reliance on informal industry networks for the sBU of Salt Specialties means that individuals and teams rely on customers, suppliers and other industrial contacts to identify opportunities. Discussions with potential and existing customers help in this matter; it strengthens them and increases their self-efficacy, their belief that they can successfully deliver the task that has to be undertaken.

At the same time the effect of participation in professional forums helps individuals and teams to recognize opportunities. Gathering information from seminars, workshops, training programs and technical publications support the search to spot new opportunities.

Last but not least identification should take place concerning informal industry networks of the sBU of Salt Specialties. These factors enhance the process of opportunity recognition.

3.5 Conclusions derived from Theoretical Framework

The theories that are described above can be roughly divided in two sources to support AkzoNobel with the innovation process of opportunity recognition. These sources are:

- Internal sources
- External sources

Internal Sources of Knowledge

The internal sources that can be abstracted from the theory are general industry knowledge and specific interest knowledge. Together these types of knowledge form the concept of prior knowledge. General industry knowledge consists of four interest points, namely:

- Prior knowledge of markets

- Prior knowledge of customer problems
- Prior knowledge of ways to serve customers
- Product specific characteristics

Both self-efficacy and schemas influence the level of absorptive capacity. A high level of absorptive capacity and / or a rising level of absorptive capacity have a positive influence on the process of opportunity recognition, value co-creation and the creation of new business. A better opportunity recognition process results in more opportunities. More opportunities lead to a better result in value co-creation, which results in new business.

Hence, there are still gaps and additional concepts needed to define a final Innovation Process Model. These gaps and concepts are located in chapter 5 'Innovation processes at AkzoNobel' and in chapter 6 'Similarities and Contrasts between Innovation Process Models and AkzoNobel practices'.

External Sources of Knowledge

The external sources of knowledge that can be abstracted from the theory are the following.

- Participation in professional forums
- Information of industry network
- Use of mentors

Participation in professional forums includes the following concepts according to the theory:

- Workshops and trainings
- Seminars
- Conferences
- Conventions
- Collaboration with universities

The information of industry networks is a very important external source of knowledge to support the process of opportunity recognition, value co-creation and new business creation. Types of information are:

- Industry related technologies
- Suppliers
- Government policies
- Competition
- Customers and end-users

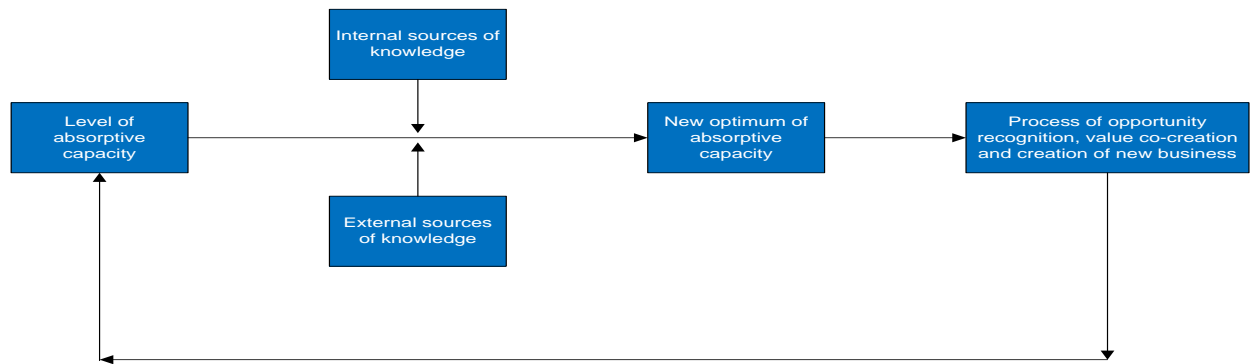
Connections between seemingly unrelated events or trends of several types of external information types and participation in professional forums support the opportunity recognition process. The use of external mentors who provide experience and extra absorptive capacity can help guide the process as well. In general external sources of knowledge in the form of participation in professional forums, information of industry network and the use of mentors are used to search solutions to satisfy perceived lack of certain specific knowledge. This search for solutions results in the evaluation of nascent ideas and finally in actions to test the feasibility of these solutions. The difference with internal sources is that external sources of knowledge consist of an encounter with an outside event. A high level of absorptive capacity and / or a rising level of absorptive capacity have a positive influence on opportunity recognition. A better opportunity recognition process results in more opportunities. More opportunities lead to a better result in value co-creation, which results in new business.

Hence there are still gaps and additional concepts needed for the external sources to define a final Innovation Process Model.

Combining Internal and External Sources of Knowledge into a Innovation Process Model

Every organization has a certain level of absorptive capacity at a certain time, which consists of randomly used internal and external sources of knowledge. If an organization starts using the IPM consisting of various internal and external sources of knowledge displayed in a structured manner, the organization enhances the prior level of absorptive capacity towards a new optimum level of absorptive capacity. This new optimum level of absorptive capacity is critical for a structured process of opportunity recognition (new ideas of technology applications), value co-creation (new product concepts) and creation of new business.

Figure 12: IPM derived from theoretical framework



4. Methodology and Data Collection

This chapter elaborates on the methodology and data collection of the research. Research and its methodology is an ongoing process of gathering and analyzing knowledge. ‘Verification of knowledge is commonly discussed in the social sciences in relation to the concepts of reliability (how consistent the findings are), validity (whether the study really investigates what you intended to investigate) and generalization (whether the findings apply outside the research setting)’, (Kvale, 1996, p. 229). According to Kvale (1996) issues of verification of the research do not belong to a separate stage of the research process; this issue should be addressed throughout the entire process of research. Validity should not be seen as a final verification, but as something that has to be built into the research process with continual checks on credibility, plausibility, and trustworthiness of the findings. Validity is not only a strict scientific principle but can be seen as quality of work of the researcher. Therefore it’s important to describe which steps have been conducted. According to Krippendorff (1980), it’s also important to describe the analytical steps to provide other researchers with instructions as to what to do in order to replicate the results.

4.1 Data collection

In order to ensure internal validity of the research, multiple data sources are used. Triangulation is realized using quantitative interviews, conducting passive and active observations of specific activities in the working environment and analysis of documents, intranet and other data. The external validity of only one case study is not strong since it is hard to generalize the results of the research, but generalization in this case study is enhanced because mostly empirical studies with significant outcomes are used in the theoretical framework. Myers (2000) suggests that while qualitative studies are not to be generalized in the traditional sense of the word, nor do they claim to be. Qualitative research certainly excels at generating information that is very detailed. The data in qualitative research is more "raw" and are seldom pre-categorized. Consequently, the researcher has to be prepared to organize all of that raw detail. And there are almost an infinite number of ways this could be accomplished.

Units of analysis

The research focuses on an IPM which is consisting of internal and external sources of knowledge. Not surprisingly the units of analysis are various sources of knowledge that are critical for a structured process of opportunity recognition, value co-creation and the creation of new business.

Units of observation

In this single case study the units of observation are of the same hierarchy level as the units of analysis.

Data Sources

Research material has to be useful to study specific objects that are central for the research. So in other words it is crucial to have a clear view of the research objects. After there is clarity about the research objects, the next question arises, ‘What types of information are relevant for the investigation?’ And last, but not least the researcher has to know where this information can be found. Below an overview of the research key objects are displayed, along with the types of information used for analyzing. The key objects and types of information are paired with the separate research questions.

Figure 13: Research questions aligned with objects and types of information

Research Question	Key objects	Sources of information
<i>What is the relationship between absorptive capacity on an individual and team level and the process of opportunity recognition, value co-creation and new business creation according to the literature?</i>	<ul style="list-style-type: none"> • Absorptive capacity • Individual and team level • Innovation Process • Opportunity Recognition • Value Co-creation • Creation of New Business 	Literature Research
Research Question	Key objects	Sources of information
<i>Which internal and external sources of knowledge are known in literature that relate to absorptive capacity of individuals and teams?</i>	<ul style="list-style-type: none"> • Absorptive capacity • Individual and team level • Internal Sources of Knowledge • External Sources of Knowledge 	Literature Research
<i>How is the process of opportunity recognition, value co-creation and the creation of new business currently structured within AkzoNobel?</i>	<ul style="list-style-type: none"> • Innovation Process • Value Co-Creation • Creation of New Business • AkzoNobel Networked Innovation • Innovation Funnel Model • RD&I • Trainings and Workshops 	Semi-structured interviews, intranet, internet, documents, media, informal interviews, e-mail, and observation.
<i>Which internal and external sources of knowledge that relate to absorptive capacity on an individual and team level are used by AkzoNobel?</i>	<ul style="list-style-type: none"> • Internal Sources of Knowledge • External Sources of Knowledge 	Semi-structured interviews, intranet, internet, documents, media, informal interviews, e-mail, and observation.
<i>What is the synopsis of internal and external sources of knowledge after comparing the literature and the practices of AkzoNobel?</i>	<ul style="list-style-type: none"> • Internal Sources of Knowledge • External Sources of Knowledge 	Literature research, semi-structured interviews, intranet, internet, documents, media, informal interviews, e-mail, and observation.
<i>What are possible new opportunities for Sanal Salt in the automotive and metallurgy industry?</i>	<ul style="list-style-type: none"> • Automotive and Metallurgy Industry • Pistons, Piston Salt Rings, Engines, Free Core Casting 	Literature research, semi-structured interviews, intranet, internet, documents, media, informal interviews, e-mail, and observation.
<i>What resources are recommended to apply the Innovation Process Model?</i>	<ul style="list-style-type: none"> • Automotive and Metallurgy Industry • Pistons, Piston Salt Rings, Engines, Free Core Casting 	Literature research, semi-structured interviews, intranet, internet, documents, media, informal interviews, e-mail, and observation.

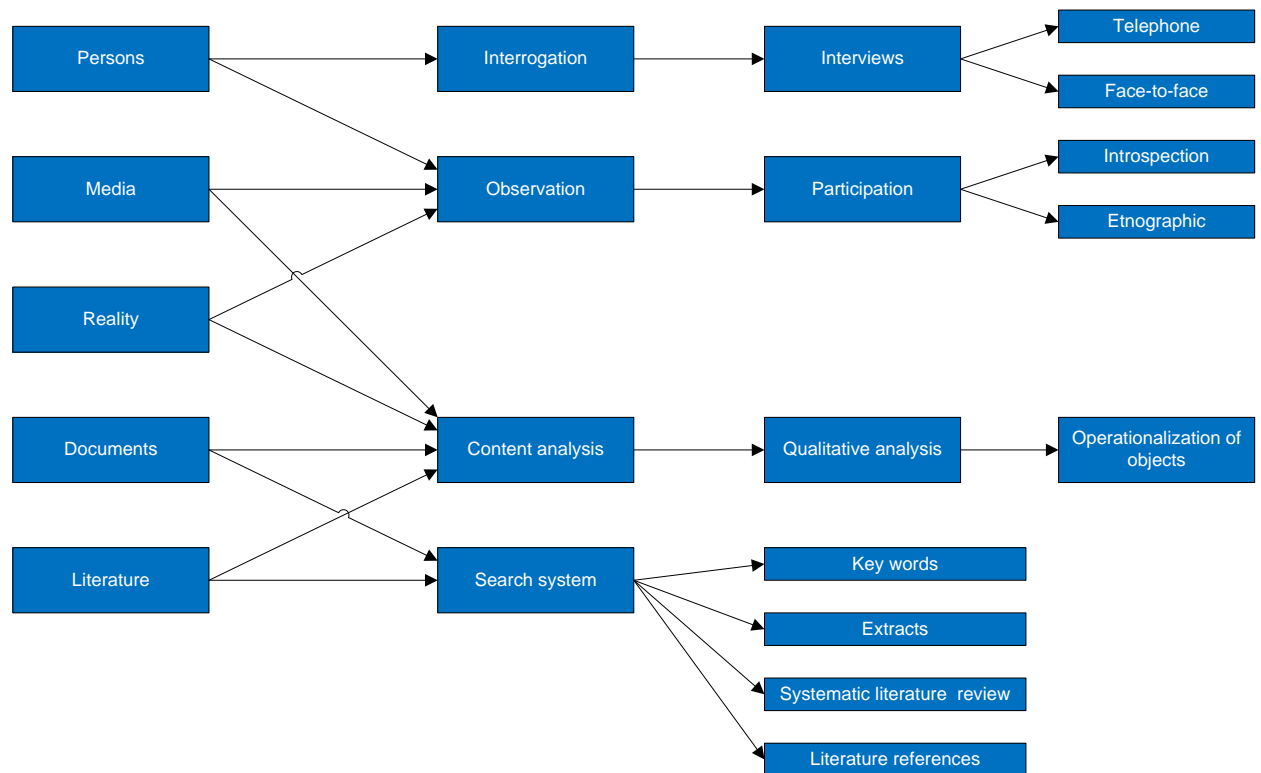
4.2 Data Collection of Key Objects from Literature Research

As is stated in figure 13 the key objects 'absorptive capacity, internal and external sources of knowledge' have been taken as a fundament for the literature research. The dominant theory behind these objects is the 'Resource Based View'. Once the researcher acknowledged this a systematic review was carried out, following an explicit methodology. Due to time constraints this review could not be too exhaustive. Therefore the researcher needed to prioritize the literature review in a systematic way.

Firstly three online search engines were selected, namely Web of Science, Scopus and Google Scholar. Web of Science and Scopus are addressed as most important and accessed at home or at the University of Twente. Google Scholar was used at AkzoNobel due to limited internet access. After the selection of search engines, key objects and keywords and their synonyms were determined, as is shown in figure 13.

A lot of articles were found this way, but the amount of articles was too large for the researcher to read. So the researcher focused on titles and selected the most promising articles. Although the amount of articles became lesser, the actual amount was still too large to read. Another screening had to be realized, which entailed the selection of useful article by judging the abstracts. After the abstracts were read, the researcher selected a variation of articles which is displayed in the references. Of course back referencing was used as a tool to find some additional useful papers and articles. Also useful articles derived from interviews and informal conversations were viewed and judged for usefulness for the research. In the bottom section of figure 14 an overview is given of the literature search system.

Figure 14: Unlocking desired Information (Verschuren en Doorewaard, 2007)



4.3 Data collection of Key Objects from the Practices of AkzoNobel

After the initial literature research certain expectations and predictions could be derived that could be useful for the empirical research within the organization of AkzoNobel. The literature

review serves as a stepping stone for refining and extending the search of current and past practices of AkzoNobel concerning internal and external sources of knowledge which are used for the process of opportunity recognition, value co-creation and the creation of new business.

The initial data collection within the organization of AkzoNobel started with a general acquaintance at the factory of the BU Functional Chemicals in Hengelo, located in the Netherlands. After several weeks of introduction, the researcher became more familiar with the corporation of AkzoNobel and within the first month a trip to the factory in Denmark was executed. Here additional knowledge about the product of Sanal Salt was collected by attending meetings and presentations of the product group of Sanal Salt. Also informal interviews were executed by the researcher about the key objects of the process of opportunity recognition, value co-creation and the creation of new business. Persons, media, reality and documents were studied in this phase of the research.

After the general acquaintance phase a deeper investigation was started. The researcher initiated a thorough search on the intranet of AkzoNobel combined with internet. Key objects and synonyms were used to search on the intranet. For instance the words 'opportunity recognition, value co-creation, new business' gave more than 12000 possible leads alone on the intranet of AkzoNobel. After several refinements were executed, like for instance setting language to only Dutch, English and German, the possible leads fairly diminished. Further refinements took place after interviewing employees of AkzoNobel that have experience and special interests concerning the key objects which are stated in figure 13.

A qualitative interview is a conversation in which the interviewer establishes a generic direction for the conversation and pursues specific topics raised by the interviewee. A qualitative interview provides the researcher with the opportunity to probe answers, where he wants his interviewees to explain, or build on, their responses (Saunders, Lewis & Thornhill, 2009). In the end only relevant sources of information remained concerning the key objects of this research. Additional interviews were held to clarify information of key objects for the researcher. These sources of information were used for data analysis. Interview types that were used in this inquiry are:

- Informal interviews: this approach produces the greatest payoff when respondents ask for the clarification they need (Conrad & Scheuber, 1999).
- Standardized open-ended interviews: allows the researcher to ask probing questions as a means of follow-up. An advantage of using this approach is that because respondents answer the same questions, answers are easier to compare; data are complete for each person on the topics addressed in the interviews (Turner, 2010).

The interview questions which were used during this research study can be found in the appendixes C and D of this thesis. Elaboration of the findings of the data collection and analysis of key objects from the practices of AkzoNobel are described in the next chapter.

4.4 Data Collection of Key Objects for the Validation of the IPM

The last two sub-questions address the validation of the IPM. These sub-questions are not specifically needed to answer the central research question and to achieve the research objective. These two sub-questions are considered a donation from the researcher to the corporation of AkzoNobel and specifically to the sBU of Salt Specialties. The gift consists of actual internal and external sources of knowledge for the sBU Salt Specialties concerning a newly recognized opportunity of Sanal Salt in the automotive and metallurgy industry. Due to the limited research time of this study, the Innovation Process Model designed in this thesis is only tested for the automotive and metallurgy industry, although the IPM is also applicable for other applications. Analyses about the key objects for the implementation of the IPM are described in chapter 8.

5. Innovation Processes at AkzoNobel

This chapter gives an overview of how innovation processes are currently structured within AkzoNobel in general. The most important aspects of innovation processes within AkzoNobel are described and explained. In other words the third sub-research question which is stated below are answered by analyzing the relevant data found within the data collection of AkzoNobel. The third research question is:

How is the process of opportunity recognition, value co-creation and the creation of new business currently structured within AkzoNobel?

After a clear view is generated about the process of opportunity recognition, value co-creation and the creation of new business, the fourth research question is answered, namely;

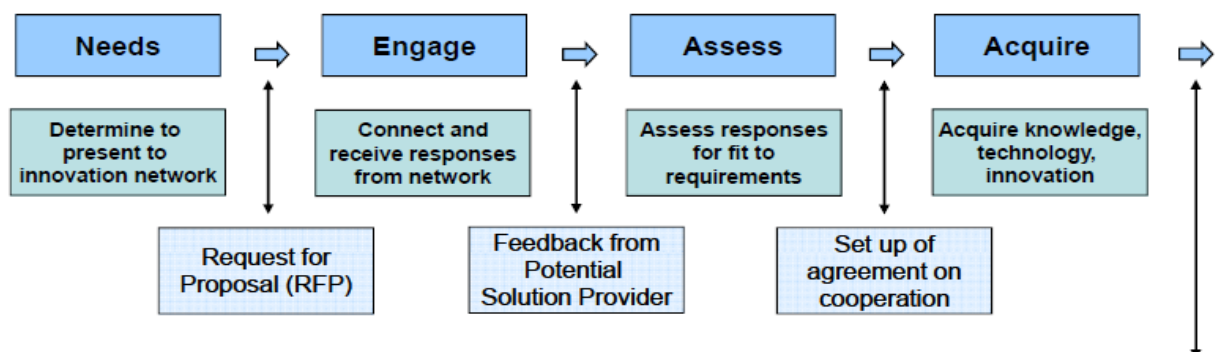
Which internal and external sources of knowledge that relate to absorptive capacity on an individual and team level are used by AkzoNobel?

Next an analysis is executed of key objects between the company AkzoNobel and the sBU of Salt Specialties concerning these currently used innovation processes, internal sources of knowledge and external sources of knowledge. An elaboration takes place about what aspects the sBU of Salt Specialties could use from these general models, methods, internal and external sources of knowledge of AkzoNobel in order to better structure the process of opportunity recognition, value co-creation and the creation of new business. Every paragraph of this chapter ends with an overview of the data sources that are used from the generated data collection.

5.1 AkzoNobel Networked Innovation (ANNI)

The institute of AkzoNobel Networked Innovation is established for three main reasons. Firstly the wheel should not be invented over and over again. Secondly, if a technology or solution is needed and is available in AkzoNobel, the organization as a whole should cooperate. And last but not least if a technology or solution is needed and is available outside AkzoNobel the organization should buy it rather than re-invent it. In general the institute of ANNI is about leveraging the global technology and innovation community. ANNI uses a citation of ChesBrough (2003) to emphasize the importance of open innovation. He states the following, ‘the presence of many smart people outside your own company is not simply a problem for you or a fact of life to be regretted. It poses an opportunity for you. If the smart people within your company are aware of, connected to, and informed by the effort of smart people outside, then your innovation process will reinvent fewer wheels’. In the figure below an overview is given of open innovation according to the institute of ANNI.

Figure 15: A structured approach to open innovation (PowerPoint presentation of ANNI 2011)



According to AkzoNobel people are very open to the ANNI approach and willing to contribute actively. One of the goals of ANNI is that colleagues start helping each other. Capabilities, know-how and answers should result in better, cheaper and faster solutions. ANNI consists of ANNI champions in every BU and over 250 trained users within AkzoNobel. According to the institute of ANNI, the concept of ANNI contributes to a culture of openness in which a vision of not-invented-here (NIH) is transformed to a vision of proudly-found-elsewhere (PFE). Using this structured approach delivers value to AkzoNobel and strengthens collective capabilities. ANNI members state that about 80% of innovations are a combination of existing knowledge.

Figure 15 gives an overview of a structured approach for open innovation. This same model is already used at the sBU Salt Specialties. The model is characterized as a market pull model. The needs are the driver for taking action. The model transforms from accessing internal sources of knowledge in the beginning to accessing external sources of knowledge in the end. For the sBU Salt Specialties and for the product of Sanal Salt the model can be explained in the following manner.

- Needs: Prioritize needs of different markets using internal and external networks. Resulting in a decision moment called 'Request for Proposal'. Within Salt Specialties this is also called Product Development Request (PDR).
- Engage: Connect and receive responses from the networks. This results in feedback from potential solution providers. For Sanal Salt this could be information about market sizes, trends etc.
- Assess: In this stage needs and resources are compared to estimate what the requirements are for fitting the initial needs and ideas with the potential solutions. For Sanal Salt this could mean an adjustment of the product itself to better serve a market need or to create a new market. This stage ends with an agreement of cooperation.
- Acquire: This is where the fitting is put into practice. New knowledge and / or technologies are acquired to fulfill the needs of the markets. These acquirements are internal and external sources of knowledge.

The data of ANNI was collected in various ways. Firstly the intranet of AkzoNobel is a powerful tool to gather information about innovation processes. After screening and searching the intranet the researcher spotted ANNI in the form of documents, presentations and electronic media. After a deeper investigation about the phenomenon the researcher conducted several interviews. The interviews had several goals.

- Interviewees functioned as data sources by sharing knowledge about themselves, their function within AkzoNobel and their experience with ANNI as users.
- Interviewees functioned as data sources by sharing information about other employees within AkzoNobel and other innovation processes.
- Interviewees functioned as suppliers of knowledge about the process of ANNI by being specialists.

5.2 Innovation Funnel Model

The innovation processes within AkzoNobel are often structured by using the innovation funnel model. This model consists of a stage-gate-process with six different stages between each gate. Below the first two stages are described, which are most important for the process of opportunity recognition. Figure 16 gives an overview of the innovation funnel. The picture has been extracted from the Business Unit (BU) Automotive & Aerospace Coatings which is part of the Business Area

(BA) Performance Coatings. Many BA's, BU's and sBU's use this model to investigate and control innovations.

Idea stage:

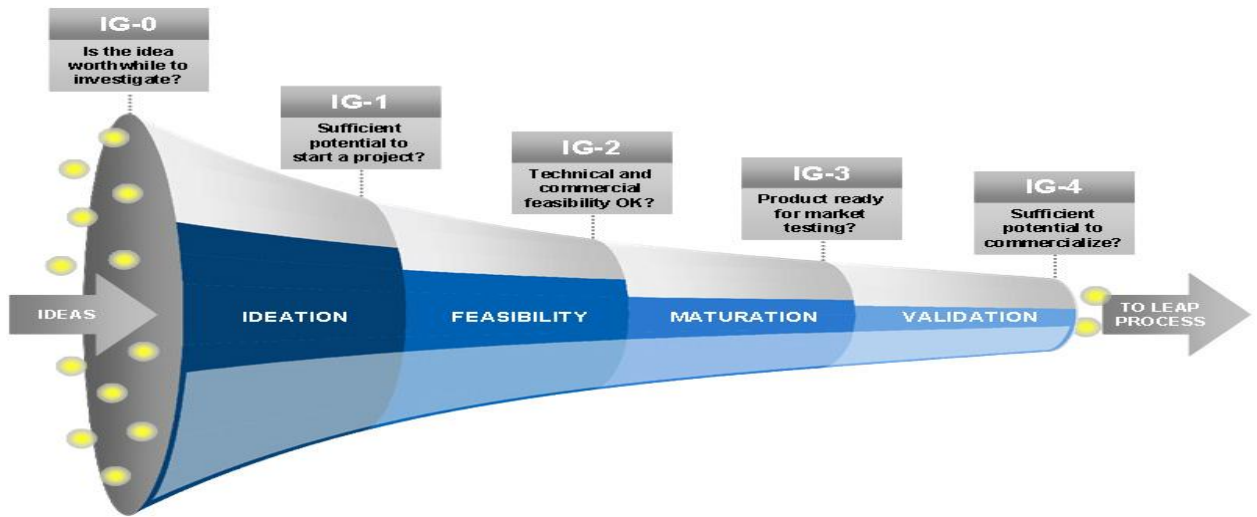
This stage is known as the creative stage of innovation. Here new ideas get a chance to surface and new opportunities can be identified. In this phase ideas and opportunities can come from internal and/or external sources of knowledge. Opportunities and ideas can come by chance or by intensive workshops, brainstorming sessions and conferences.

An important aspect in this stage is information. Information about current problems in the business, information about competitors, information about clients and markets, information about technologies and information about the company and its strategy and its objectives. Clarity of information is often an important stimulus for opportunity identification and idea generation. The first stage is a filter stage; furthermore the stage is a storage point where ideas and opportunities can be developed into workable and more concrete concepts. Often ideas of the past that weren't workable can achieve the status workable in the present or future. A central question in this stage is: is the idea worthwhile to investigate?

Ideation stage:

Central in the ideation stage is the following question; does the idea have sufficient potential to start a project for it? In other words this stage is to transform the initial idea in a concrete and workable concept. According to du Preez & Louw (2008), once a concept has been defined and documented, some time should be provided to share the concept with different people in order for the concept to incubate and maybe refine some of the ideas. At the end of the stage a filter process occurs. The ideas and opportunities that are the most promising are selected and further developed in the next stages.

Figure 16: Innovation Funnel abstracted from the BU Automotive & Aerospace Coatings



The sBU of Salt Specialties uses a similar innovation funnel model for the process of opportunity recognition, value co-creation and creation of new business. The data for the innovation funnel was also collected in various ways. Firstly the intranet of AkzoNobel is a powerful tool to gather information about innovation processes. After screening and searching the intranet the researcher spotted the innovation funnel in the form of documents, presentations and electronic media. After a deeper investigation about the phenomenon the researcher conducted several formal and informal interviews about the topic of innovation funnels and their use in innovation processes.

The interviews had to goals, namely;

- Obtaining knowledge about the use of the innovation funnel, in which the interviewees functioned as an informants
- Obtaining specialists' knowledge about the use and positive effects of the innovation funnel for the sBU Salt Specialties.

5.3 Research, Development and Innovation

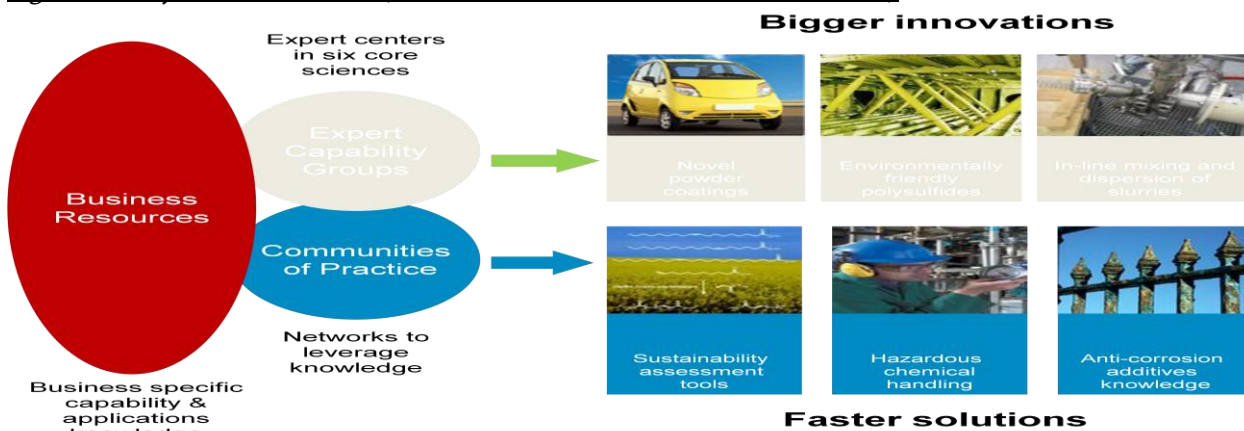
Next to the innovation funnel model the organizational model of Research, Development and Innovation (RD&I) is connected with opportunity recognition, value co-creation and creation of new business at AkzoNobel. RD&I consists of nearly 4000 active scientists and technologists who perform leading-edge research, product and process development and provide technical support for the BU's and manufacturing operations. These employees of RD&I are based in more than 160 laboratories world-wide.

The research model for RD&I exist of three interlocking elements. About 95 percent of the research population is based in BU's. As stated on the intranet website of AkzoNobel, scientists and technologists are the customer-facing, applications-driven powerhouse of the RD&I. Their task is to develop and support new products and create better processes for making them. They are supported by corporate teams of scientists organized into five Expert Capability Groups. They work as partners in the Business Innovation Teams, delivering expertise in particular fields of science and technology that are critical for innovation programs. The third leg of AkzoNobel organizational model is the system of Communities of Practice (CoP). These are virtual "super networks" of experts in particular fields. It is their role to ensure that the best possible use of the product knowledge, applications know-how and customer needs are shared and made within the company, by bringing together technical and other experts in innovation. Their role is also to propose solutions to fix gaps in collective knowledge, hence absorptive capacity.

Especially the CoP group is interesting when looking at the process of opportunity recognition, value co-creation and creation of new business within AkzoNobel. A CoP is a group of people interacting and working together across the entire AkzoNobel organization, having a common interest in sharing knowledge and know-how about a topic that is important to them individually and strategically relevant to the company as a whole. The CoPs provide a mechanism for pooling the internal knowledge of the organization and sharing best practices for the benefit of all involved. It enables AkzoNobel to solve problems and identify opportunities more quickly and cost-effectively by reducing duplication of effort and it is a mechanism for identifying gaps in collective knowledge. Furthermore CoPs deliver recommendations for action at business and AkzoNobel level. Currently six CoPs exist and more are in genesis. The CoPs that exist are:

- Color and Effects
- Corrosion Protection
- Efficient Cross-linking
- Process Efficiency
- Renewable Raw Material
- Waterborne Technologies

Figure 17: Key elements of CoP (abstracted from the intranet of AkzoNobel)



The biggest benefits of the CoP model are the following:

- Problems solving with reduced time and costs.
- Improving, speeding up projects by synergies and sharing best practices.
- Identification of new opportunities.

Normally the CoP model is a top-down initiative to stimulate cross BU cooperation, but there is a bottom-up approach needed to make this cooperation happen. The CoP model can also be used intra sBU. It can help to create an efficient network within the sBU. In this network problems can be shared and solved. The CoP helps with identification, development, sharing and implementation of best practices. The CoP is a collective knowledge entity, which supports the development of innovative solutions and ideas. It also serves as an information facility for specific subjects that are valuable for the sBU.

In figure 18 the CoP concept is shown. A well established CoP model in practice consists of the following actions, which are directly derived from the intranet website of AkzoNobel.

Core Team Meetings	Expertise
Special Interest Teams (working groups)	Best Practices
Inter-BU Contacts and Interactions	WebEx presentations (Webinars)
Discussion Forums	Newsletters
Source of Knowledge	Technical Help Function

Figure 18: The CoP Concept (abstracted from AkzoNobel intranet)



The rate of success of the CoP model is still being researched by AkzoNobel employees, but some conclusions can be drawn already. For instance the feedback success rating of information sharing and technical help request of the CoP discussion forum of 'Efficient Cross-linking' are promising. Of 18 posts, viewed in December 2011, 33% generated a good/excellent solution, 45% were useful ideas and 22% had no response or just some information. These results are currently still being researched, especially the section of 22% of no response or just some information. But according to the CoP leader of Efficient Cross-linking the most obvious reason for this percentage is the vague description of problem statement of certain topics.

In order to successfully implement the CoP model several steps have to be made during the first two years. The first half year starts with a kick-off, a website has to be generated for discussion and information forums. Furthermore an inventory must take place for CoP technologies. Also an overview of R&D projects on different projects should be generated and a newsletter should be written on a monthly basis. Last but not least in the first half year of the CoP implementation the focus should be on fast growth of the number of members. In the second half of the first year, clear goals and strategies should be stated on the website. Furthermore the focus should be on knowledge exchange on specific subjects. Also active discussion forums should be a point of focus, members are crucial here. Last but not least obtaining results and reviewing results should take a central place in this period.

In the second year gap analyses should be performed. Technology and market gaps concerning projects should be analyzed for each business area. Furthermore during the gap analyses, proposals should be given for approaches, solution concepts and strategic decisions. Another important focus point is to support the top R&D projects. Also a start has to be made with challenging workshops and webinars.

To conclude the CoP can be a source of technical and market information for the sBU Salt Specialties. It is a valuable toolkit for gaining and sharing knowledge and experience. It increases the network capacities and the reputation of the sBU. More details about the CoP and what it could mean for the sBU Salt Specialties can be found in chapter 8.

The data of RD&I and the CoPs was collected in various ways. Firstly the intranet of AkzoNobel was used to gather information about innovation processes. After screening and searching the intranet the researcher spotted the processes from above in the form of documents, presentations and electronic media. After a deeper investigation about the phenomenon the researcher conducted several interviews. These interviews had several goals.

- Interviewees functioned as data sources by sharing knowledge about themselves, their function within AkzoNobel and their experience with RD&I and CoP as users.
- Interviewees functioned as data sources by sharing information about other employees within AkzoNobel and other innovation processes.
- Interviewees functioned as suppliers of knowledge about the process of RD&I and CoP by being specialists of these processes.

5.4 Trainings and Workshops

AkzoNobel organizes trainings and workshops for employees to become more innovative and to better understand the concept of innovation. Multiple examples of trainings and workshops can be found on the intranet of AkzoNobel. Below three examples are briefly summarized.

Stage-Gate Training at the business area of decorative paints

Goals of this training are for instance fewer but bigger innovations. Other goals are faster leverage across regions, reduction of complexity and using one common innovation process across the globe, namely the Stage-Gate process.

ANNI champion training

Expectations and goals of this training are the overall familiarity with ANNI process steps. Exercises in needs selection, brief writing and proposal evaluation are key concepts. Another goal is the initiation of Networked Innovation Champions (NIC) activities, for instance refine the role, charter and metrics which have to be used.

Technology and Innovation Project

The purpose of the T&I Project was to develop processes that would drive technology leadership, help create a more innovative environment and realization of increased percentages of sales of own technology based products. This addresses the long term strategy for new technology development by each of the sBU's and the effective understanding of customers and markets.

In order to get a better grip on opportunity recognition, value co-creation and creation of new business process, the sBU Salt Specialties should be more active in organizing obligatory and voluntary trainings and workshops.

The data of trainings and workshops for employees was collected in various ways. Firstly the intranet of AkzoNobel was used to gather information. After screening and searching the intranet the researcher spotted the trainings and workshops for employees from above along with many others in the form of documents, presentations and electronic media. After a deeper investigation about the phenomenon the researcher conducted several interviews. These interviews had several goals.

- Interviewees functioned as data sources by sharing knowledge about themselves, their function within AkzoNobel and their experience with trainings and workshops for employees.
- Interviewees functioned as data sources by sharing information about other employees within AkzoNobel and trainings and workshops for employees.
- Interviewees functioned as suppliers of knowledge about the trainings and workshops for employees by being specialists of these processes.

5.5 Other Internal and External Sources of Knowledge within AkzoNobel

Next to the previous processes of opportunity recognition, value co-creation and creation of new business, several other internal and external sources of knowledge were spotted that support individuals and teams absorptive capacity and thus support a structured IPM. These internal sources of knowledge are:

- Reading and publishing in newspapers, magazines and trade press
- Corporate electronic and hardcopy newsletters
- Patent searches and alerts systems
- Product specific characteristics
- Intranet websites of AkzoNobel
- Internet websites

According to several interviewees staying up-to-date about industry and technology trends is very important for the process of opportunity recognition, value co-creation and the creation of new business. Reading and publishing in newspapers, magazines and trade press supports this. Also new patent searches and alerts of patents by using information systems which are supported by AkzoNobel help to support the process of recognition, value co-creation and the creation of new business. Furthermore understanding and having knowledge about product specific characteristics

helped to enhance the absorptive capacity of individuals and teams. Of course staying up-to-date also means regularly checking and screening the intranet and internet.

External sources of knowledge for individual and team are:

- Conferences
- Conventions
- Internet communities
- Collaboration with universities

Various interviewees stressed that conferences and conventions are important external sources of knowledge that support the process of opportunity recognition, value co-creation and the creation of new business. Furthermore a small group of interviewees acknowledged that they used internet communities as an external source of knowledge and during several interviews the fact of collaboration with universities was mentioned which enhanced the absorptive capacity of individuals and teams within BU's and sBU's.

5.6 Conclusions derived from findings at AkzoNobel for Salt Specialties

A high level of absorptive capacity and / or an increasing level of absorptive capacity have a positive influence on the process of opportunity recognition, value co-creation and the creation of new business. A better opportunity recognition process results in more opportunities. More opportunities lead to better results in value co-creation, which results in new business. The feedback loop from opportunity recognition, value co-creation and new business is also derived from the ANNI and Innovation Funnel Models.

In short the models and methods used by AkzoNobel complement and reinforce the internal sources and external sources of knowledge which are extracted from the theory. This is useful and valuable knowledge for the sBU of Salt Specialties.

Though the corporation of AkzoNobel does not make much use of external sources of knowledge when looking at the process of opportunity recognition, value co-creation and the creation of new business. Especially the parts of value co-creation and new business creation are often kept inside the company instead of looking outside the company. This is the case for most BA's BU's and sBU's within AkzoNobel. Furthermore it is essential to say that the sBU Salt Specialties uses limited resources of knowledge that are available in other parts of the organization of AkzoNobel. This is especially the case when focusing on the level of individuals and teams. Various forms of data and the analysis of this data support the fact that a lot of internal and external sources of knowledge could be used better or aren't used at all within the sBU of Salt Specialties. Elaboration of this statement can be found in chapter 8.

6. Similarities and Contrasts between Innovation Process Models and AkzoNobel Practices

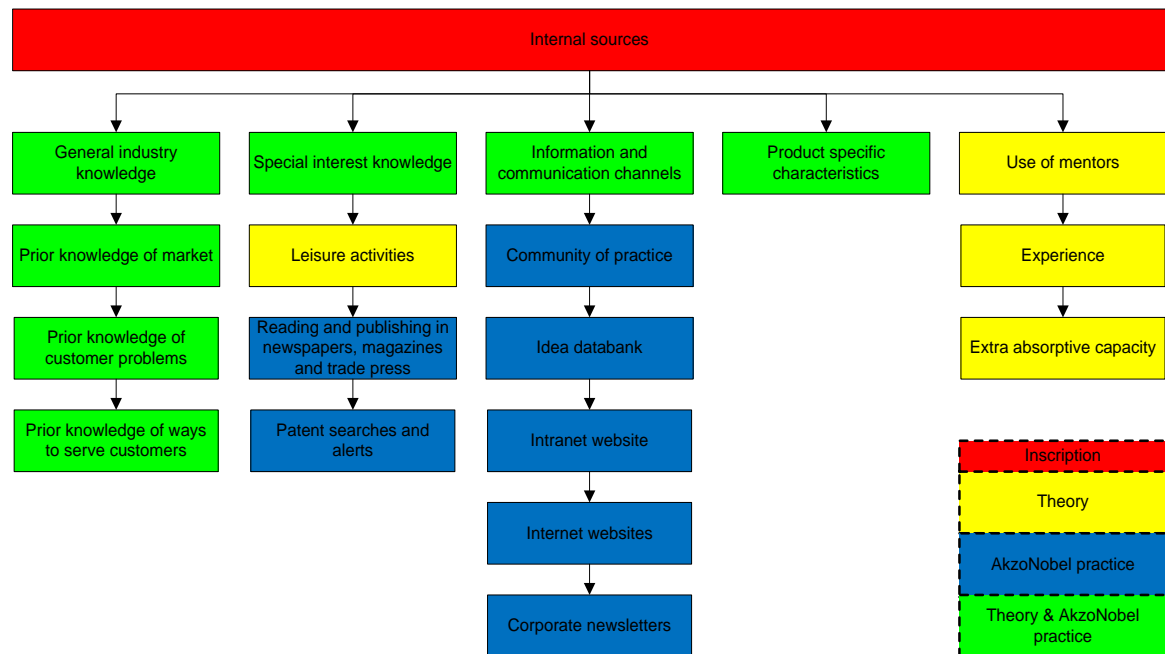
After a thorough investigation of elements of theory about Innovation Process Models and elements of practices of AkzoNobel several fits and gaps are revealed. This chapter sums up these fits and gaps, which are the pedestal for the definitive Innovation Process Model (IPM).

6.1 Similarities and Contrasts concerning Internal Sources of Knowledge

In figure 19 an overview is given concerning similarities and contrasts between Innovation Process Models which are abstracted from theory and practices of AkzoNobel. These similarities and contrasts entail only elements of internal sources of knowledge, hence the red building block in the top of the figure.

The yellow building blocks are purely derived from the theoretical framework, which is elaborated in chapter 3. Next to the yellow building blocks the blue building blocks are purely derived from currently existing practices at AkzoNobel, which are explained in chapter 5. And finally the green building blocks represent elements of internal sources of knowledge, which are derived from the theoretical framework as well as the currently existing practices at AkzoNobel.

Figure 19: Similarities and Contrasts of Internal Sources of Knowledge



General Industry Knowledge

Both theory and practice acknowledge the importance of the building block of general industry knowledge in the IPM. Theory and practices of AkzoNobel are very clear it is important to have prior knowledge of markets, customer needs and ways to serve customers. This building block is crucial for a structured process of opportunity recognition, value co-creation and the creation of new business. Both AkzoNobel Practices and Innovation Process Models from the theoretical framework acknowledge that general industry knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Ardichvili et al. 2003 and ANNI).

Special Interest Knowledge

Although the theoretical framework and the practices of AkzoNobel underline the importance of special interest knowledge of employees in the IPM, both use different elements for operationalization.

Theory underlines the importance of leisure activities and the relation of those activities to opportunity recognition and value co creation. According to Von Hippel (1994), people tend to only notice information that is related to information they already know. Differences in prior knowledge cause differences in understanding information, which in the end cause a difference in recognizing opportunities. A larger pool of prior knowledge of individuals results in a larger entrepreneurial alertness.

AkzoNobel Practices underline elements like reading and publishing in newspapers, magazines and trade press and the use of patent search and alert systems to be important as a concept of special interest knowledge. Several interviewees addressed these elements during interviews as special interest knowledge, which helped them in the process of opportunity development, value co-creation and finally the creation of new business.

Information and Communication Channels

Elements of theory about Innovation Process Models and elements of practices of AkzoNobel state the importance of quality and quantity of information and communication channels.

Theory about Innovation Process Models confirms that the access of knowledge can be improved by obtaining a central network position in an organization. This network consists of inter-unit links and the network is an important part of a learning process in which organizational units discover new opportunities and obtain new knowledge through interacting with one other, in other words innovative ideas are often at the nexus of inter-unit links (Tsai, 2001). Hence it acknowledges the importance of this building block, but it does not give tools how to improve information and communication channels.

Contrary, the practices gathered from AkzoNobel are useful for operationalization of this building block. Elements of ANNI and the CoP in combination with intranet and internet websites create effective and efficient information and communication channels which are critical for internal sources of knowledge.

Product Specific Characteristics

In scientific literature a lot of theory can be found about uniqueness of products in combination with the importance for creating new markets, understanding customer needs and competitive advantage. Core products and their typical characteristics are the backbone for every profitable organization and therefore also for AkzoNobel. A good understanding of product specific characteristics is crucial for the IPM. Only then a success process of opportunity recognition and value co-creation and new business creation can exist.

Use of mentors

The theory used in this thesis underlines the importance of internal mentors in the organization. These mentors support entrepreneurial alertness and individual innovative behavior of employees. Internal mentors improve the process of opportunity recognition, value co-creation and the creation of new business, because they bring extra experience and absorptive capacity into the organization, hence internal sources of knowledge.

The practices of AkzoNobel don't amplify the use of mentors. Of course AkzoNobel uses functional leaders, but these types of leaders don't accentuate extra experience and absorptive capacity. This doesn't mean that AkzoNobel doesn't have internal mentors, because every organization has internal mentors. In the organization of AkzoNobel, these mentors can be found in the projects of ANNI and CoPs. But there is a great difference in knowing that these mentors

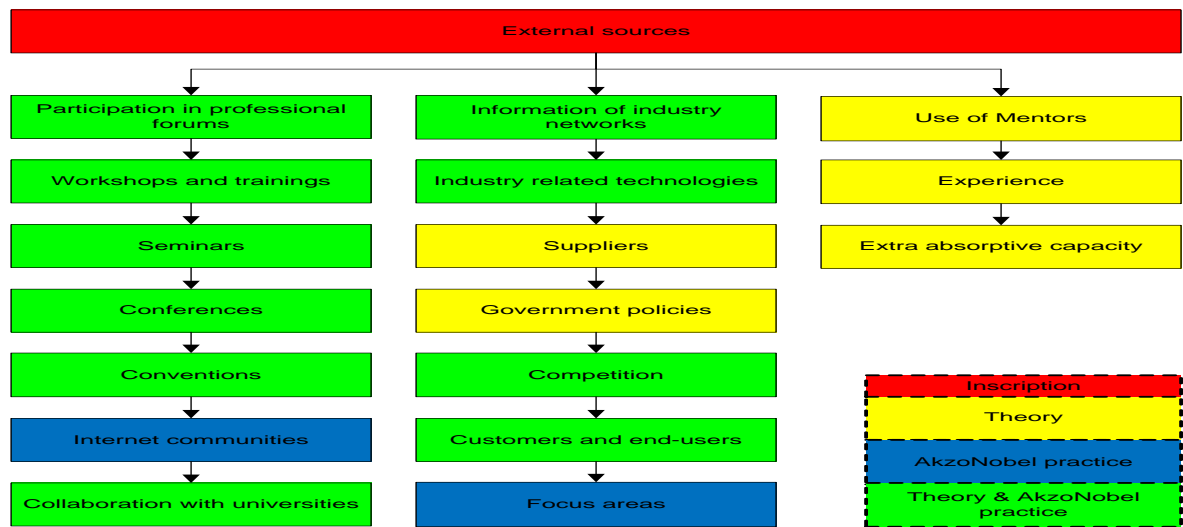
even exist and actually using these internal mentors in the process of opportunity recognition, value co-creation and the creation of new business.

6.2 Similarities and Contrasts concerning External Sources of Knowledge

In figure 20 an overview is given concerning similarities and contrasts between Innovation Process Models which are abstracted from theory and practices of AkzoNobel. These similarities and contrasts entail only elements of external sources of knowledge, hence the red building block in the top of the figure.

The yellow building blocks are purely derived from the theoretical framework, which is elaborated in chapter 3. Next to the yellow building blocks the blue building blocks are purely derived from currently existing practices at AkzoNobel, which are explained in chapter 5. And finally the green building blocks represent elements of external sources of knowledge, which are derived from the theoretical framework as well as the currently existing practices at AkzoNobel.

Figure 20: Similarities and Contrasts of External Sources of Knowledge



Participation in Professional Forums

Similarities in the theoretical framework of chapter 3 and practices of AkzoNobel in chapter 5 are found in the following elements; workshops and trainings, seminars, conferences, conventions and collaboration with universities. The effect of participation in professional forums helps individuals and teams to recognize opportunities. Gathering information from seminars, workshops, training programs and technical publications support the search of new opportunities (Baron, 2004).

On the other hand a contrast can be found in the use of internet communities as a form of participation. Although not the whole organization of AkzoNobel is known with this element, some business areas use internet communities to encounter outside events which help with new opportunity recognition, value co creation and creation of new business. Interviewees in several other sBU than the sBU Salt Specialties stressed that they used these internet communities to gather knowledge which they used for the process of opportunity recognition.

Information of Industry Networks

Both theory and practice address the importance of information about industry networks. Similarities are mainly found in the elements of information about competition, industry related technologies, customers and end-users. According to the theoretical framework, information of industry networks supports filtering and refining opportunities (Bhave, 1994). Furthermore

information of industry networks refers to specific knowledge. This confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. Hence information of industry networks enhances a firm's absorptive capacity (Cohen & Levinthal, 1990).

Net to the theoretical framework, the practices of AkzoNobel also support the importance of information of industry networks. For instance, ANNI exists partly for the reason if a technology or solution is needed and is available outside. Then AkzoNobel should buy it rather than re-invent it, hence ANNI gathers information concerning industry networks.

Furthermore the CoPs also gather information of industry networks by using Webinars where the invite guest speakers from different industries, who can provide AkzoNobel with recognizing new opportunities.

Contrasts in the theoretical framework and practices of AkzoNobel exist in the elements of suppliers, government policies and focus areas. Theory stresses the importance of element of suppliers concerning information of industry networks, but during interviews, none of the interviewees addressed this element specifically. The reason for this is that AkzoNobel almost always fulfils the role of supplier itself. Also the element of government policies is not stressed explicitly at the practices of AkzoNobel, but during interviews it became clear that AkzoNobel works with the concept of focus areas (FA). The definition of these FA's is very broad and include many fields of knowledge and expertise, including a quick scan of government policies, which might be important for the new opportunity and business.

Use of Mentors

The theory used in this thesis underlines the importance of external mentors as well as internal mentors. These external mentors also support entrepreneurial alertness and individual innovative behavior of employees. External mentors improve the process of opportunity recognition, value co-creation and the creation of new business, because they bring extra experience and absorptive capacity into the organization, hence internal sources of knowledge.

The practices of AkzoNobel don't amplify the use of external mentors. This doesn't mean that AkzoNobel doesn't have external mentors, but during interviews not even one external mentor was mentioned as an example of an external source of knowledge.

7. Design of the proposed Innovation Process Model

In this chapter the fifth sub-research question is answered, namely;

What is the synopsis of internal and external sources of knowledge after comparing the literature and the practices of AkzoNobel?

The design of the IPM exists of multiple building blocks, these are described below.

Internal Sources of Knowledge

Internal sources are sources that are hard, focused and closely aligned to operational requirements. According to Svetina & Prodan (2008), 'internally, firms acquire knowledge through in-house research and development activities and by learning from continuous improvements in processes.' Important in the management of internal sources are acquisition, storage and maintenance. Internal resources of the Innovation Process Model are explained in detail in paragraph 7.1.

External Sources of Knowledge

External sources of knowledge are defined as information external to the organization. According to Svetina & Prodan (2008), external sources of knowledge are accessed if firms do not have appropriate knowledge inside the firm, they can acquire it externally by cooperating with customers and suppliers, as well as other firms, or by forming partnerships with public, semi-public, and private institutions. External sources are more difficult to manage than internal sources, because analysis and interpretation are essential to determine the value, relevance and usability. Instead of being valuable at a daily basis, external sources are valuable at a strategic basis. External resources of the IPM are explained in detail in paragraph 7.2.

Absorptive Capacity

Absorptive capacity causes assimilation and use of new knowledge and can cause progressive improvement for AkzoNobel. It results in 'learning to learn' and adequate 'problem solving' and gives insight to employees and teams which finally result in opportunity recognition and value creation. Although there is a precondition for this process, namely the intensity of effort is crucial. Considerable time and effort should be spent to improve absorptive capacity. More information about the concept of absorptive capacity can be found in paragraph 3.3 of this thesis.

Opportunity Recognition

Opportunity recognition describes the specific 'eureka' experiences, when suddenly an idea crystallizes. Typically, it is the initial idea which is described as the moment of opportunity recognition (e.g. Hills, 1995). Building on these considerations, the process of recognizing opportunities can be defined as efforts to make sense of signals of change (e.g., new information about new conditions) to form beliefs regarding whether or not enacting a course of action to address this change could lead to net benefits (for instance, in terms of profits, growth, competitive jockeying, and/or other forms of individual or organizational gains). The outcome of this process lies in those subjective ex ante beliefs that an opportunity exists, or not, for the willing and able (Shepherd et al. 2007).

Value Co-Creation

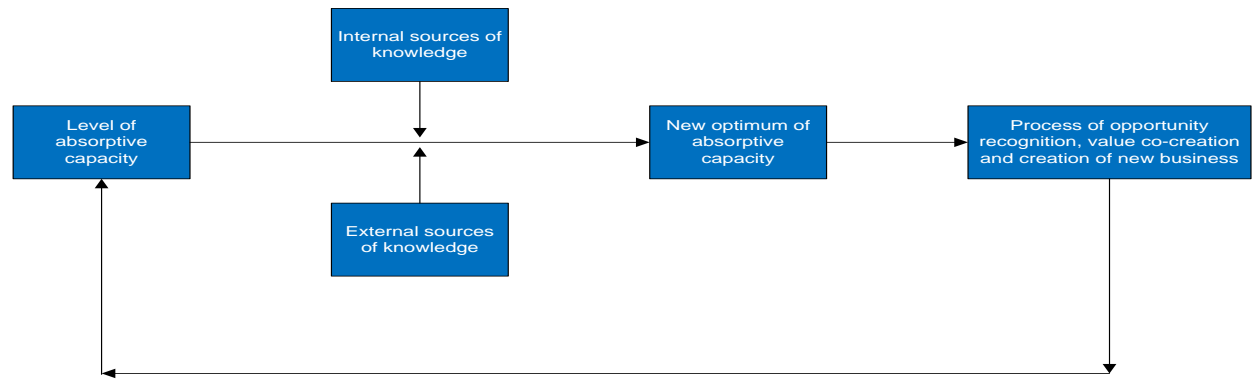
Companies need to embrace a new approach to value creation, one in which the basis for value shifts from products to experiences; consumer influence is spread across the value chain (in research and development, design, manufacturing, logistics, service, and points in between);

conflicts between companies and consumers are more visible and resolved more productively; and companies don't dictate how value is created. In short, companies must learn to co-create value with their customers (Prahalad & Ramaswamy, 2002).

New Business

New business is derivative of a successful business concept, which is usually defined as an opportunity which has been fully developed to include how specific products are produced and reach (with benefits) identified customers (De Koning & Muzyka, 1999). New business finds its path in existing and new markets.

Figure 21: Design of the proposed Innovation Process Model IPM



7.1 Internal Sources of the proposed Innovation Process Model

The internal sources of the Innovation Process Model (IPM) consist of five major factors. Each major factor can be shown in more detail, which is useful for the process of opportunity recognition, value co-creation and creating new business. The five major factors are displayed below along with the more detailed aspects.

Internal Sources

- 1) General industry knowledge
 - a) Prior knowledge of markets
 - b) Prior knowledge of customer problems
 - c) Prior knowledge of ways to serve the customer
- 2) Special interest knowledge
 - a) Leisure activities
 - b) Leisure activities supported by the organization
 - c) Reading and publishing in newspapers, magazines and trade press
 - d) Patent searches and alerts
- 3) Information and communication channels
 - a) Community of Practice (COP)
 - b) Idea databank
 - c) Intranet website of AkzoNobel
 - d) Internet websites
 - e) Corporate newsletters

- 4) Product specific characteristics
 - a) Purity
 - b) Shape
 - c) Mass
 - d) Size
 - e) Etc.
- 5) Use of mentors
 - a) Experience in known and / or unknown markets
 - b) Extra absorptive capacity

7.2 External Sources of the proposed Innovation Process Model

The External sources of the Innovation Process Model (IPM) consist of three major factors. Each major factor can be shown in more detail, which is useful for the process of opportunity recognition, value co-creation and creating new business. The three major factors are displayed below along with the more detailed aspects.

External sources

- 1) Participation in professional forums
 - a) Workshops and trainings
 - b) Seminars
 - c) Conferences
 - d) Conventions
 - e) Internet communities
 - f) Collaboration with universities
- 2) Information of industry networks
 - a) Industry related technologies
 - b) Suppliers
 - c) Government policies
 - d) Competition
 - e) Focus areas
 - f) Customer and end-user
- 3) Use of mentors
 - a) Experience in known and / or unknown markets
 - b) Extra absorptive capacity

8 Implementation of IPM at the sBU Salt Specialties

Now that the definitive IPM is designed, what remains to be done in this chapter is to apply the model to the sBU Salt Specialties and specifically to the products of Sanal Salt. Although a good start can be made in this thesis with the application phase, it must be said that it is a preliminary application of the IPM due to time restrictions of this study. The IPM designed in this thesis is tested for the automotive and metallurgy industry. Thus, the choice is made for an in-depth investigation instead of investigation in width. Further limitations of this thesis and the IPM are stated in chapter 11. The sixth and seventh sub-research questions are:

What are possible new opportunities for Sanal Salt in the automotive and metallurgy industry?

What resources are recommended to apply the Innovation Process Model?

These two sub-questions are considered a donation from the researcher to the corporation of AkzoNobel and specifically to the sBU of Salt Specialties. The gift consists of actual internal and external sources of knowledge for the sBU Salt Specialties concerning a newly recognized opportunity of Sanal Salt in the automotive and metallurgy industry.

8.1 Internal Sources of Knowledge

Product Specific Characteristics

In order to successfully find specific characteristics of a product first a synopsis of as much as possible characteristics of the product should be displayed. After this task is completed, specific characteristics can be abstracted. An overview of pharmaceutical salt characteristics is already presented in paragraph 2.4. Below a list of product specific characteristics of Sanal Salt is given.

- The pharmaceutical salt of AkzoNobel (Sanal®) is of the highest quality.
- Sanal Salt is sodium chloride in its purest form without additives.
- Sanal® is free-flowing.
- Sanal® P (NaCl content >99.96%) is suitable for the manufacture of parenterals, haemodialysis, haemofiltration, haemodiafiltration and peritoneal dialysis solutions.
- Sanal® SQ (NaCl content >99.99 %) is suitable for use as fine chemicals pursuant to ACS requirements, microelectronics, micro galvanic processes, haemodialysis, haemofiltration, haemodiafiltration and peritoneal dialysis solutions.
- Comply with the monographs of all international pharmacopoeia, Ph. Eur., USP, JP, KP, Ph. Rus. and Ch. P. API quality and FDA approved.
- Sodium chloride is its necessity for the human body (self steering mechanism).
- Sodium chloride as a chemical is very stable product (melting point of 801°C and a boiling point of 1465 °C)
- Sodium chloride is soluble in water.
- Sodium chloride attracts moisture, the smaller the crystals of sodium chloride the bigger accumulation of sodium chloride particles.
- Dry storage (relative humidity < 75 %) of sodium chloride is recommended.
- Under pressure sodium chloride can be compacted into a solid and strong form.

Prior Knowledge of Markets, Customer Problems and Ways to Serve the Customer

Sodium chloride is used in casting process of pistons and other metallurgy processes. Market research is very important to gain advantage over the competition. Market research can result in

crucial information which helps to identify and analyze markets needs, the size of the markets and the information about the competition.

In the case of AkzoNobel, market research is focused on business to business (B2B) market research. This is far more complicated than market consumer research (Malhotra, 2006). Reasons are:

- Finding the right respondents and information is crucial, but since every business is often very busy they could be not willing to participate. Getting other businesses to open up to share information is an important skill.
- The decision making units are far more complex than in B2B than in consumer markets.
- Products and applications are far more complex than consumer products.
- B2B markets are smaller in number of customers and larger in consumption of products.
- Good personal relationships are critical in B2B markets.

Prior knowledge of markets, customer problems and ways to serve customers should be able to answer or at least have an idea about the following questions:

Market Size & Geography

What is the potential market size of the intended venture?

Historically, the pistons for diesel engines have adopted the use of sodium chloride rings for years, but recently pistons for gasoline engines also started to use sodium chloride rings, in order to increase horse power. The manufacturer of pistons, Shandong Binzhou BoHai Piston Co. Ltd., claims that Honda is considering the use of sodium chloride piston rings for a new automobile. This model may need 320.000 rings containing 20g a piece; this is 6400kg of Sanal® P each year. This amount is only for one manufacturer of piston rings. In the building block external sources 'Information of industry networks' a list of potential customers can be found which can be translated in the market size of the potential new business.

How fast is the market growing and where are the opportunities?

The market of salt piston rings is considerably growing. The general trend of piston production is that diesel engines use internal cooling; this trend is also the case for future gasoline engines. The volume of engines becomes smaller due to economical and environmental global reasons. This means that the temperature and pressure of engines becomes higher in engines, hence internal cooling becomes even more important. Smaller engines are less heavy and that translates into more energy friendly engines.

What is the geographical scope of the market?

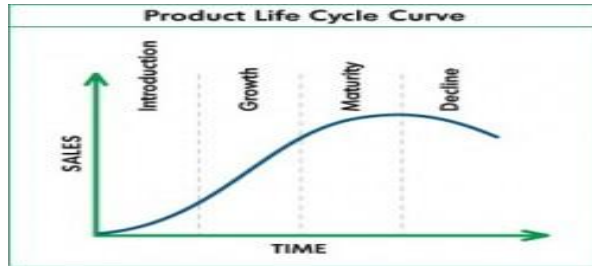
The scope of the market is worldwide, especially in emerging economies. The BRIC countries, Taiwan, Turkey and countries in Eastern Europe are the key manufactures of pistons. Labor costs are relatively inexpensive in these countries compared to developed countries.

What is the development stage of the market?

The development stage of the piston market is that of rapid growth (figure 22). The increasing demand of engines and engines parts in emerging economies is a major cause of this phenomenon. This increasing demand is also applicable for sodium chloride piston rings, due to economical and environmental global reasons.

Driven by expanding demand in the Asian economies and new product developments, worldwide pistons, piston rings and engine valves market is forecast to reach 2.5 billion units by 2010 (http://www.prweb.com/releases/piston_rings_pins/engine_valves/prweb860284.htm). This data addresses only the automotive industry and doesn't imply types of pistons and engines used in other industries. For instance other industries where pistons are used are; maritime, aviation, railway, compressor, steam hammers, pumps, industrial applications and cranes.

Figure 22: Product life cycle, market stages



Market Segments & Customers

Who are the customers and end-users?

The customers for AkzoNobel are piston manufacturers who use sodium chloride piston rings in their production process. End-users are major car manufacturers who make use of an internal lubrication and cooling system. Other end-users are defined in the previous section.

What are the key requirements of the customers and end-users?

Knowing that the cost of a single defective component is far higher in the casting part of the process because of material cost, casting processing costs, energy used and the cost of all preceding processing steps, than in the first stages of production of the ring, the lower the defective figure in the casting process is important from an economical point of view. The purity of Sanal Salt is critical for a successful casting process when margins for internal cooling channels are relatively small (20,0 mm - 5,0 mm). But also the strength of the salt piston rings is important during the casting process. Sanal Salt supports these conditions.

For end-users it is important that the volume of engines becomes smaller due to economical and environmental global reasons. This means that the temperature and pressure of engines becomes higher in engines, hence internal cooling becomes even more important. Smaller engines are less heavy and that translates into more energy friendly engines.

Well documented information about the general industry factors and clarity increase the possibility of a successful process of opportunity recognition, value co-creation and creation of new business. Once a good overview is created one or several markets can be picked that promise the greatest potential. At this point the internal sources of the company are often depleted and the organization needs to start using external sources in order to satisfy perceived lack of knowledge and to evaluate the nascent ideas.

Special Interest Knowledge and Leisure Activities

Special interest knowledge of individuals and teams exists of what individuals and teams enjoy in private life (Ardichvili et al., 2003). These interests can support the organization with additional knowledge. For instance individuals with affinity for certain countries invest their leisure in gathering information about these countries. Holidays, literature and other forms of culture are

absorbed by individuals to fill the gap of desire to know more and more. This extracted information can be valuable for companies and the successfulness of opportunity recognition. Other examples of valuable special interest knowledge for the sBU Salt Specialties and the products of Sanal Salt in combination with the automotive and metallurgy industry are described below.

- Leisure activities concerning holidays, culture, history and geography of Brazil, Russia, India and China. This can help understand new growth markets better.
- Leisure activities concerning automotive industries and metallurgy. New trends in engine types, concerning lubrication and cooling systems.
- Leisure activities concerning energy storage and environment. Energy and environment are present day and future topics for every business.
- Leisure activities in world politics. This can help understanding governmental regulations better. Could help import, export, manufacturing etc.

Leisure activities can be supported by the organization. For instance the motivations and experiences of individuals in each of these fields of special interest could be encouraged. Encouragement can be realized by money, time, transport etc. The real question AkzoNobel has to ask itself is if special interest knowledge is worthy investing in. Clarity in the form of results is often hard to get.

Reading of Newspapers, Magazines and Trade Press

Individuals that often read newspapers, magazines and trade press about developments in science in general or about automotive and metallurgy topics are often better in recognizing new opportunities for sodium chloride and pharmaceutical salt like Sanal Salt. These forms of extra absorptive capacity are a stimulus for opportunity recognition, value co-creation and in the end for the creation of new business. Although AkzoNobel has pointed out special individuals that can access trade press and professional magazines, it is not always clear to other employees who to these special individuals are. But the most important issue is getting individuals and teams to read and apply these sources periodical. Knowing what is happening in different fields is the start of opportunity recognition.

Publishing in Newspapers, Magazines and Trade Press

Some departments of AkzoNobel use this source but not all. Publishing in newspapers, magazines and trade press has a push and pull component which both address opportunity recognition. An example of publishing in newspapers and magazines at the sBU Salt Specialties is the product group food. The relatively new concept of 'Loso OneGrain' that has been published in local and national newspapers causes new opportunities and recognition of new opportunities of various customers in the food market.

Publication of Sanal Salt and product specific characteristics can also be the starting point of new opportunities and value co-creation. Other businesses could be able to integrate their absorptive capacity with the technology of Sanal Salt. Hence, open innovation can occur by publishing general information of product specific characteristics and applications.

Community of Practice of sBU Salt Specialties

What is remarkable is that there is no CoP for Salt Specialties. A CoP for Salt Specialties certainly helps to recognize and identify new opportunities. A global network of experts and practitioners sharing knowledge and expertise in order to achieve strategic advantage by creating added value and innovations across Salt Specialties is a big step forward. The biggest benefits for Salt Specialties implementing a CoP are the following points:

- Problems solving with reduced time and costs
- Improving, speeding up projects by synergies and sharing best practices
- Identification of new opportunities

Normally the CoP model is a top-down initiative to stimulate cross BU cooperation, but there is a bottom-up approach needed to make it happen. For Salt Specialties the CoP model can be used intra sBU also. It helps to create an efficient network within the sBU. In this network problems can be shared and solved. The CoP helps with identification, development, sharing and implementation of best practices. The CoP is a collective knowledge entity, which supports the development of innovative solutions and ideas. It also serves as an information facility for specific subjects that have value for the sBU. A well established CoP model in practice for Salt Specialties should consist of the following actions; these actions are directly derived from the intranet website of AkzoNobel.

- Core team meetings
- Special interest teams (work groups)
- Inter-BU contacts & interactions
- Discussion forum
- Source of knowledge
- Expertise
- Best practices
- WebEx presentations (Webinars)
- Newsletters
- Technical help function

To implement the CoP the following steps should be taken. The first half year starts with a kick-off, a website must be generated for discussion and information forums. Furthermore an inventory must take place for Salt Specialties technologies. Also an overview of R&D projects on Salt Specialties projects should be generated and a newsletter should be written on a monthly basis. Last but not least in the first half year of the CoP implementation the focus should be on fast growth of the number of members.

In the second half of the first year, clear goals and strategies should be stated on the website. Furthermore the focus should be on knowledge exchange on specific Salt Specialties subjects. Also active discussion forums should be a point of focus, members are crucial here. Last but not least obtaining results and reviewing results should take a central place in this period.

In the second year gap analyses should be performed. Technology and market gaps concerning Salt Specialties should be analyzed for each business / category group within Salt Specialties. Furthermore during the gap analyses, proposals should be given for approaches, solution concepts and strategic decisions. Another important focus point is to support the top R&D projects. Also a start has to be made with challenging workshops and webinars. Last but not least more explicit contacts have to be made with BRIC countries which are viewable for the CoP. This creates additional value to the sBU Salt Specialties.

To conclude the CoP can be a source of technical and market information for the sBU Salt Specialties. It is a valuable toolkit for gaining and sharing knowledge and experience. It increases the network capacities and the reputation of the sBU.

Idea Bank

An idea bank is often a website where individuals and teams can post ideas which can lead to new opportunities. Ideas of the past, present and future are posted, discussed and exchanged. The idea bank improves the ideation process which is described in the Innovation Funnel Model of AkzoNobel. The reason that the idea bank is separately mentioned from the CoP states the

importance of the concept. The sBU Salt Specialties is in need of a storage system for new ideas, which is easy accessible for every employee within the organization. Idea banks support innovative working behavior and nurture an organization's culture of innovation. Although most ideas are limited to incremental types of innovations (doing things the way we always have, but better). But what is wrong with that? It often results in cost savings or a rapid gain in revenue. Out of the box thinking, which causes breakthrough or radical innovation is better supported by the CoP system. In order to make an idea bank successful, scores have to be given in different topics of the idea.

Figure 23: Example of prioritizing ideas on value of the idea

Topic	Description	Points	Score
Customer Needs	Not clear	0	
	There is a need	10	
	Needs are defined	20	
Market potential	Less than 1 million Euro	0	
	Between 1 and 5 million Euro	10	
	More than 5 million Euro	20	
Capability	It isn't possible yet	0-5	
	Organization is able to deliver	10	
Innovativeness	It is not new	0	
	It is partial new	5	
	It is totally new	10	
Total score of idea	Maximum score is 60		

The example from above can be filled up with ideas of the product group of Sanal Salt. For instance a better view can be generated about the value of the idea of using pharmaceutical salt in the casting process of pistons and other metallurgy applications.

Intranet Websites

The sBU Salt Specialties has its own intranet website. Employees can find interesting information about the sBU and employees can post important information that they want to share with AkzoNobel in general and specifically with the sBU. Though, the use of sharing internal information is not used extensively, compared to other sBU's and BU's of AkzoNobel.

Next to information that is displayed on the intranet website, intranet is also used to contact other employees within the organization. The system called 'Cheops' is a database which contains information of all employees of AkzoNobel. Next to contact information, Cheops also shows fields of expertise, networks and hierarchy of employees. Cheops is a useful tool to gather more information to help crystallizing new ideas.

Another way to get more information is viewing the news and views magazine on the intranet. For instance the following news can be a starting point for Salt Specialties in creating an effective network.

"AkzoNobel is to significantly boost its presence in the Chinese automotive market after agreeing to acquire Changzhou Prime Automotive Paint Co., Ltd. Financial details were not disclosed. Prime is one of China's largest vehicle refinish suppliers and a leader in the fast-growing mid-market segment. This sector is estimated to double in size within the next five years. Based in Jiangsu Province, the company develops, manufactures, markets and distributes automotive coatings, primarily for the refinish market."

This Chinese organization could have extensive or informal connections with other parts of the automotive industry, for instance the engine and piston sections. New contacts are easier established by using existing networks than by creating new networks.

Also other news about trends in emerging economies sometimes can be found on the intranet of AkzoNobel. For instance the following news section addresses the importance of new engines that are more economical and environmental friendly.

“SINGAPORE (ICIS)--China will see growing demand for liquefied natural gas (LNG) powering road vehicles, with approximately 82% of the nation's LNG usage going to vehicles in coming years, an official at oil and gas giant PetroChina said on Thursday.

Vehicle fuel will become the most important downstream market for LNG, said Qi Zhibin, vice president of PetroChina Planning and Engineering Institute, speaking at the 2012 China International LNG Conference in Beijing.

Increasing LNG consumption in China also corresponds to the nation's policy of energy savings and emission cuts, which the central government has been vigorously enforcing in the last few years, Qi added.”

Furthermore a decrease of sales in the automotive sector in Europe can be found on the intranet. This is also important information for opportunity recognition and making choices for new business.

“New registrations for passenger cars in the 27-member EU in May fell for the eighth consecutive month. According to data from the European Automobile Manufacturers' Association (ACEA), 1,106,845 new passenger cars were registered in the region in May, down 8.7% from the same month in 2011. In the first five months of 2012, new registrations for cars in the EU fell by 7.7% year on year to 5,442,326.”

Internet websites

Internet is a very useful internal source for AkzoNobel and therefore also for the sBU Salt Specialties. A lot of information can be found on the internet about automotive and metallurgy topics. In the external source section the topic of internet communities and its value are discussed. In this internal source section a general view about the value of internet is explained.

Internet is a very valuable tool to gather information about all kinds of topics. This is also the case for gathering information about the automotive and metallurgy industry. For instance knowledge about pistons, salt piston rings, engines, lubrication systems, cooling systems, environmental regulations and BRIC countries can be found on the internet. For instance if one would enter the search term ‘piston sodium chloride’ at Google.com, one finds on the first page documentation about the development of piston sodium chloride cores for the high duty engines (<http://www.scientific.net/AMR.146-147.556>). This is important information for opportunity recognition of Sanal Salt.

Next to gathering information and knowledge, internet is also a valuable tool for sharing information and knowledge. AkzoNobel uses internet websites for sharing information with the public. Internet websites are crucial to get in contact with potential customers. The organization should clearly share its vision and mission. This vision and mission should be translated all the way down the organizational business units and sub-business units. During the research of this thesis the following came to the attention of the researcher. Although AkzoNobel is a large company, the company isn't displayed on the first page on Google when people search on the terms ‘sodium chloride’ or ‘salt’. This gets even worse when you use the term ‘zout’ the Dutch translation of sodium chloride. In Dutch, AkzoNobel is only for the first time visible on page five of Google. The same applies to the case of pharmaceutical salt. This is a lost opportunity to get in contact with possible customers. To be in the top rank of search engines like Google.com is an important factor

for organizations to get publicity and acquaintance with potential customers. For the sBU Salt Specialties and for the product of Sanal Salt it is important to get this publicity and acquaintance in combination with the automotive and metallurgy industries.

The next step in using the internet as a sharing tool for information is the structure of the internet site. For front-end stages of new product development processes suggestion boxes, advisory panels, virtual communities and web-based idea markets are valuable tools to improve the ideation and concepts of new opportunities (Sawhney et al, 2005). The internet site of Sanal Salt (<http://www.sanalsalt.com>) does not have one of these tools.

Corporate Newsletters

AkzoNobel quarterly publishes the magazine 'One World' for the global company. Furthermore a special edition is published for countries and last but not least editions for specific manufacturing locations. These magazines are published for employees and keep them informed about internal and external developments.

In the country and local magazines lots of information is shared about the sBU Salt Specialties, which is logical since the Netherlands and Hengelo are major manufacturers of sodium chloride. But in the global edition the sBU is under developed in sharing information. Focusing on the products of Sanal Salt reveals another missed chance in sharing information. The products and developments are seldom or never mentioned in global, country and local magazines. Especially possible new applications and trends of Sanal Salt should and could be pushed more into the organizational publicity. Again publicity and acquaintance within the company itself can generate new ideas and suggestions for the product of Sanal Salt and for the sBU Salt Specialties in general.

Use of Mentors

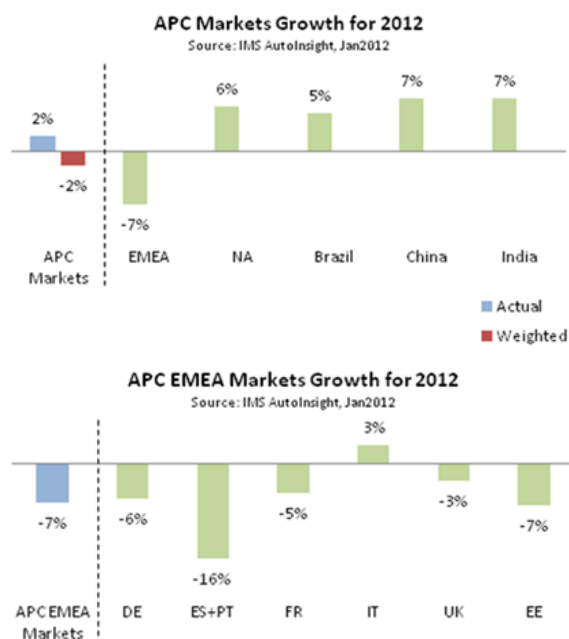
Reliance on mentors for the sBU of Salt Specialties is important, having a mentor that helps obtaining and interpreting opportunity relevant information, increases opportunity recognition for individuals and teams of the sBU of Salt Specialties. Furthermore the reliance of mentors strengthens the schemas of individuals and teams, by providing them with extensive experience and additional information. This could result in an improved opportunity recognition phase. In the case of the product Sanal Salt perhaps mentors can be found in other parts of the organization.

It seems logical to assume that mentors can be found in the BU of Automotive and Aerospace Coatings, who can support the sBU Salt Specialties and the product group of Sanal Salt with additional information about the automotive and metallurgy industries. Hence, the internal source section about the intranet website of AkzoNobel gives already clues for this statement. The next source is from the intranet of AkzoNobel.

"Following the car production forecast over the last few months of Global Insight, there is a general decrease in the number of cars which are predicted to be produced during 2012. The high growth markets and North America will still grow in 2012, although at a lower rate than initially forecasted, however, EMEA is forecasted to produce less cars this year than last year. During the last three months these car production figures for 2012 have been decreasing, which is showing the trend of a slowdown in the automotive market, probably as a reflection of the uncertainty in global economy for this year. Below is a breakdown per country and region of the forecast for 2012. These figures, even though they are coming from an independent and very prestigious source such as Global Insight, should be taken cautiously and more as a trend pointer than as one hundred percent true for the future. Moreover, there are always segments, OEM brands and specific cars, which sell more or less than the market average, making them the winners or losers of the market. A closer look will also provide a deeper understanding of the specific situation of APC in the automotive market in each country. Month after month we will continue evaluating this data in order to follow

the market evolution to stay on top of the situation and be prepared for the future. If you would like to receive more information on this, please contact Sebastian.Pordomingo@akzonobel.com”

Figure 24: Predictions automotive market growth 2012



Next to mentors in the organization in the form of colleagues, mentors can be found in the form of relatives and friends who have accumulated knowledge and experience about automotive and metallurgy industries.

8.2 External sources of knowledge

Workshops and Trainings

Workshops and trainings are useful tools to generate new ideas and to expand absorptive capacity by increasing the current knowledge of individuals and team members. New opportunities often reveal themselves during workshops and trainings. Workshops and trainings not only produce new ideas, they also enhance communication and teambuilding.

At AkzoNobel workshops and training are not obligatory. Every year employees can attend multiple trainings and workshops in consultation with their managers. Managers often initiate these ideas, but employees can emphasize the need of training and workshops too.

Useful topics for workshops and trainings for individuals and teams within the sBU Salt Specialties are:

Idea generation and conceptualization of ideas

Examples of useful organizations that can help out with workshops and trainings about this topic are:

- Sun-Idee (<http://sunidee.com>): This organization helps companies to innovate successfully. Questions that are addressed are; how to become more relevant for your clients, how to align the organization and work as a winning team, how to outsmart the competition and how to create value and to make a business grow?

- 360 Creative Services (<http://www.360creativeservices.nl>): The goal of this organization is supplying concept ideation workshops that target the generation of ideas for new products or services.
- Gro3 (<http://www.gro3.com>): This organization is specialized in projects for business innovation. The main services include workshops, brainstorming, contracting and coaching.

Customer Needs and Problems

Examples of useful organizations that can help out with workshops and trainings about this topic are:

- The Strategy Workshop (<http://www.thestrategyworkshop.com>): This organization learns how to develop breakthrough strategies using the proven Strategic Fit Program. Examples of modules are how to identify and meet your customer needs and how to win in a competitive environment.
- New Product Development Solutions (<http://www.npd-solutions.com>): This organization addresses the importance of capturing the voice of the customer (VOC) to drive product development, presents how to undertake various VOC methodologies, discusses when they should be used, and leads participants through the process of planning how to capture the VOC. The workshop includes exercises to develop practical experience with various VOC methods and results in the development of a VOC plan for an actual product opportunity.

Culture concerning Contacts with BRIC Countries

Examples of useful organizations that can help out with workshops and trainings about this topic are:

- Eyes-on-China (<http://www.eyesonchina.com>): In-house workshops for the understanding of Chinese business culture. Workshop in the Netherlands given by both Dutch and Chinese experts. Developed by Eyes-on-China and PMC Connect.
- China Workshop (<http://chinaworkshop.nl/>): This organization answers questions like; how does the organization intercommunicate with China as a market and Chinese workers? This training provides a good preparation.
- Booming India (<http://www.boomingindia.biz/diensten/workshop/index.html>): For entrepreneurs and managers, companies, business associations, trade associations and business clubs Booming India organizes workshops and seminars where they introduce you to business with and in India.

Workshops about Trends in Automotive and Metallurgy Industries

Examples of useful organizations that can help out with workshops and trainings about this topic are:

- Chambers of Industry and Commerce (AHKs) in Germany.
(<http://china.ahk.de/events/chamber/shanghai/working-groups/workshop-automotive-industry/>): The workshop presents an opportunity to discuss trends in automotive markets that impact to local developments with industry experts. The intent is to follow the themes of global megatrends and the main drivers of automotive developments.
- Industry Group Holland Automotive (HA)
(http://www.nevat.nl/Sectoren/Holland%20Automotive.aspx?sc_lang=en): Organization for collective workshops and trainings.

- Conference-Service (<http://www.conference-service.com/conferences/nl/metallurgy.html>): This organization offers an overview of upcoming scientific and technical meetings.

Seminars

Seminars are academic instructions held at an academy or offered by another professional organization. Small groups of people are gathering for recurring meetings which are focused on a specific topic. Members of the seminars participate actively and the seminar has a leader or instructor who guides the group. The group is not consisting of beginners in knowledge on the specific topic. Practical problems are addressed and assigned readings are discussed in debates about the topic at hand.

Before the sBU Salt Specialties decides that seminars can be useful to help find new opportunities for specific product groups, they have to be certain that the prior knowledge level of individuals is high enough to participate. Trainings and workshops can elevate this level of knowledge. Topics for useful seminars are the same as those for workshops and trainings.

Conferences and Conventions

Conventions and conferences are meetings at a specific time and place where individuals are gathered to discuss some common interest. For AkzoNobel, the sBU Salt Specialties and specifically for the product group Sanal Salt, these conferences and conventions should be based upon particular industries or industry segments. In the case of the piston sodium chloride rings these segments are: pistons, engine, automotive metallurgy and casting industries. Below several conferences and conventions are displayed that could increase the knowledge of individual employees of the sBU Salt Specialties and the absorptive capacity of AkzoNobel.

Holland Automotive (http://www.nevat.nl/Sectoren/Holland%20Automotive.aspx?sc_lang=en)

The objectives of Holland Automotive are:

- 1) Strengthening the (inter) national competitiveness of Dutch suppliers in the automotive industry.
- 2) Actively providing general and specific information to the members about interesting developments and markets.
- 3) Active marketing execution on behalf of the affiliated companies.
- 4) Active participation in national and international networks that are interesting for the member companies, including the Federation Holland Automotive and the Automotive Technology Centre.
- 5) Provide collective solutions for industry specific problems including risk management and recall.
- 6) Provide a network for suppliers.

These objectives are realized by:

- Organizing 'Director Meetings' (member meetings).
- Organizing collective workshops and trainings.
- Visiting potential customers on behalf of member companies (individual).
- Organizing trade gatherings (collective).
- Executing collective researches (including The Dutch automotive industry; an inventory of the industry).
- Participating in international tradeshow.
- Exchanging points of view with the Dutch government on a regular basis.
- Organizing a collective benchmark project.
- Actively realizing Dutch contribution to international networks.
- An e-mail newsletter (bi-weekly) and a member bulletin (nine times a year).

Automotive Digest (<http://automotivedigest.com/events>)

Automotive Digest shows one of the most complete listings of annual and special automotive industry events, conferences, shows, and company activities. Examples of interesting subjects on the agenda for the sBU Salt Specialties are the following:

- Fuel Efficient Engine Summit
- Center of Automotive Research
- Advanced Lightweight Materials Summit

Ingenieurgesellschaft Auto und Verkehr (<http://www.iav.com/en/events/iav-conferences>)

The organization attaches huge importance to teamwork and interdisciplinary communication. This is why IAV holds regular specialist conferences on exciting topics covering all aspects of automotive development. Examples of interesting subjects on the agenda for the sBU Salt Specialties are the following:

- Symposium Automotive Power train Control Systems
- IAV Conference: Gas-Powered Vehicles - The Logical Approach
- Conference: Advanced Ignition Systems for Gasoline Engines
- Conference: Design of Experiments (DoE) in Engine Development
- Conference: Knocking at gasoline engines

These conventions and conferences entail keynote speakers, new product development and other information and activities which could be of interest of AkzoNobel. Of course more conventions and conferences can be traced on the internet.

Internet Communities

Online special interest groups are useful, with interests in advancing a specific area of knowledge, learning or technology, where members collaborate to affect or to produce solutions within their specific field. These communities communicate, meet and even organize conferences. For AkzoNobel, the sBU Salt Specialties and the product group of Sanal Salt the following websites and communities online are interesting for opportunity recognition in the piston industry.

Specifically for sodium chloride:

- www.saltinstitute.org (general forum about sodium chloride and applications)
- <http://www.eng-tips.com> (metallurgy processes and development)
- <http://www.alloyavenue.com> (metallurgy and chemistry)

Opportunity recognition in general:

- www.triz-journal.com
- www.handsonrapidinnovation.com
- <http://nfteconnect.org> (teaching entrepreneurship)

In the section below several internet communities are described in detail. These communities show useful information and network options for the piston sodium chloride application of the sBU of Salt Specialties.

Internet community: Intelligent Work Forums for: <http://www.eng-tips.com/viewthread.cfm?qid=192018>

- Topic: Oil Temperature
- Posted by: 'turbomotor' (Mechanical)

“In modern high BMEP diesel engines, cooling the piston top ring land with oil has become a major enabling technology. High performance light diesels (Mercedes, Audi and BMW) have recently used salt cores to make oil cooling channels in the piston. Mahle now has a piston with a cast-in-place oil cooling gallery that has been production released in some engines concurrent with a large rated power and torque increase (such as the Duramaz LLY engine). Oil can absorb heat quickly, but it’s not great at getting rid of the heat.”

The post in the forum from above shows that sodium chloride piston rings are a new trend and that there is a possible business opportunity for Sanal Salt in this type of industry.

- Topic: pistons without rings?
- Posted by: ‘patprimer’ (Publican)

“The internal combustion engine as we know it today is highly developed and manufactures are under constant pressure to reduce costs while improving fuel efficiency, emission performance, power, drive ability and durability.”

- Topic: pistons without rings?
- Posted by: ‘patprimer’ (Publican)

“How these add up as a percentage of total friction varies enormously with speed and load and design so trying to allocate percentages is really pointless unless a specific set of conditions is specified. It is also not much real world value unless the conditions relate to real world use and lead to a real world benefit, like to reduce fuel use at the most typical load and speed. Having said that, I am sure ring friction is on average a high portion of friction and I am sure there is a lot of work done toward improving seal, improving durability and reducing friction. Reducing the ring tension, reducing the ring width and reducing the number of rings can all reduce friction, but may reduce seal quality and or durability. It is all a trade off.

Precision machining, accurate prediction of size change and distortion of pistons and bore, type of materials and bore finish can all help reduce friction, but at the end of the day, all these things are compromises and the designers set the best balance of properties they can with consideration to performance, market acceptance and cost.”

The previous posts in the forum show the trends of efficiency, effectiveness and environmental friendly engines.

- Topic: performance and wear vs. coolant/oil temperature.
- Posted by: ‘CentralCoaster’

“Thinner Oil does reduce friction losses, but multi-grade oils contain a viscosity improving additive, which actually allows the oil to increase viscosity with higher temperatures. That being said, oil viscosity is not the primary reason that an engine is more powerful the hotter it gets. The main factor is simple thermodynamics. Fuel contains a certain amount of energy. In the cylinder, that stored energy is dissipated several ways, some exits through the exhaust, some is used to overcome friction, some is transferred to the crankshaft, and some is rejected to the engine coolant as heat. The more energy (heat) rejected to the coolant, the less available there is to transmit to the crankshaft. However, there are two factors working against a hot engine. One is the induction air temperature, the other is detonation (as you mentioned). All else being equal, running an engine on the brink of detonation is going to extract the most power from the fuel. Of course that is a fine

line between maximum power and ruining your engine, so engineers will design to stay a good margin below the detonation limit. If you keep a close eye on detonation, you can easily extract more power out of a stock engine. Induction air also plays a role, as shown by the SAE J1349 formula for correcting horsepower at a given ambient (assuming constant pressure):

$$cf = 1.18 * [(T + 273) / 298]^{1.5} - 1.18$$
-----T is in Celsius.

So assuming your induction air is the same as your water temperature, your correction factor would be 1.10 for the 180F thermostat and 1.122 for the 195 F thermostat. This is less than a 2% difference. The thermodynamic gain will more than offset the loss due to the increased induction air temperature.”

This topic gives more insight in the performance of engines and the importance of lubrication and cooling of pistons in the engine.

- Topic: DI Engines.
- Posted by: 'riktoo'

“The particulates, NOx and other dirty little molecular friends are happy to reproduce at temperatures which are not ideal for combustion. A flame front varies in temperature because the head, the valves, the cylinder walls and the pistons are all working at different temperatures. Cylinders made of steel absorb heat at a different rate than the aluminum pistons, the stainless steel valves and the aluminum heads. So, how to reduce flame front variations of temp.? One good way is to reduce the heat transfer to the head to pistons and valves and to the cylinder walls.”

This topic stresses the importance of cooling of the piston heads and the cooling of engines in general. Sanal Salt can be an opportunity for cooling channels inside the piston heads.

Internet Community: Dutch Automotive Portal (<http://www.automotive-industry.nl/>)

Here you can find all information concerning the Dutch automotive industry, information about companies, test facilities, education and publications all related to the Dutch automotive industry. Additional information can be found about the industry and its highlights, technological and process innovations, human capital and the latest news and events. A special automotive discussion forum can be found within the network section.

Collaboration with Universities

Another external source that can be used to recognize / identify new opportunities is collaboration with universities. AkzoNobel has some of these collaboration pacts with universities around the globe. For instance, in the Netherlands AkzoNobel collaborates with the University of Wageningen for agriculture business. In the case of opportunities for sodium chloride products and especially pharmaceutical salt the sBU Salt Specialties could contact several universities in the Netherlands which are displayed below.

- University of Utrecht
- University of Twente
- University of Groningen
- Radboud University Nijmegen
- Technical University Delft
- University of Leiden

Collaboration can focus on several areas which are described below.

- Business development
- Technical development
- Market development

Of course these areas can be even more focused to help the sBU Salt Specialties to develop new ideas in corporation with students of universities. Next to these focus areas additional opportunities can be identified in the form of creating a useful networks for future events and staying up-to-date with developments in science.

Industry related Technologies

At this point the internal sources of the company are often used at the maximum and the organization needs to start using external sources to search to satisfy perceived lack of knowledge and to evaluate the nascent ideas.

Questions that couldn't be answered with internal sources should be answered using external sources. It is very important that the following questions should be answered in order to get a successful opportunity recognition and value co-creation which should result in new business creation.

What are the most important economic forces driving this industry?

Economic forces refer to the nature and direction of the economy in which the business operates. These forces have an enormous influence on corporations and their businesses. The general state of the world wide economy is that of cautious recovery. Although most pistons are produced in BRIC countries where the economy is booming, the majority of piston sales take place in the Western World. This is still a valid trend, but in 20 years a shift will take place in the market of piston sales which point to the direction of Eastern economies like China and India. So investment in these countries is a wise decision for AkzoNobel. The Gross National Product (GNP) of BRIC countries keeps increasing and will surpass the Western World dominance as we know it today.

Source: Global Industry Analysts , Inc.

“Automotive industry forms an essential component of the global economic activity. Its vast size has far reaching influence on diverse industries and sectors, both backward and forward. The automotive components market is primarily influenced by the number of new vehicles manufactured, which is significantly affected by the prevailing economic conditions. Demand for the aftermarket parts and accessories is based on various factors including vehicle purchase, weather conditions, and factors such as number of miles driven by the vehicle and the average life of parts and accessories. Europe and United States collectively command over 50% of the global demand for pistons, piston rings and engine valves market, as stated by Global Industry Analysts, Inc. Europe represents the largest [pistons, piston rings and engine valves market](#) with volume sales estimated at 752 million units for 2008. The European pistons, piston rings and engine valves market operates in tune with the region's automobile industry. Germany represents the largest market for pistons, piston rings and engine valves, with sales projected to touch 209 million units by the year 2010. Asia-Pacific is projected to be the fastest growing regional market over the 2000-2010 period, as majority of the sales growth in the automobile industry originates from Asia-Pacific markets. As established automakers from North America, Europe, and Japan enter the region, Asian producers continue to increase their production and compete in overseas markets. [Engine valves market](#) is forecast to witness the fastest growth at a CAGR of over 3% over the period 2000-2010. The increasing demand for 4-stroke vehicles constitutes another factor that is projected to drive the global market for piston rings. The trend is particularly evident in the developing regions with

customers moving towards vehicles with 4-strokes, which require five piston rings. United States is the single largest [piston rings](#) market in the world, with sales estimated at 271 million units for 2008. The report titled "Pistons, Piston Rings And Engine Valves: A Global Strategic Business Report" published by Global Industry Analysts, Inc. analyzes the market for the period 2001-2015. Analysis is presented for the United States, Japan, Asia-Pacific, Middle East and Latin America. Leading players profiled in the report include Burgess-Norton Manufacturing Company, Elgin Industries, Federal-Mogul Corporation, Hastings Manufacturing Company, Kolbenschmidt Pierburg AG, Mahle International GmbH, Nippon Piston Ring Co Ltd, and TRW Automotive."

What are the most important technological forces driving this industry?

Technological forces have influences on organizations. Technological innovations can have positive and negative effects on the environment of organizations. For instance the technology development of engines and pistons can have a positive effect on the sBU Salt Specialties and on the product group of Sanal Salt. Changes in processing methods and the use of raw materials in the piston industry could be beneficial for AkzoNobel. The general rate of change in the automotive industry is constant, towards efficiency, effectiveness and environmental friendly engines. Sodium chloride piston rings fit this type of change in engines. Other changing opportunities in the metallurgy and casting industries should be identified and forecasted too, to find new opportunities.

Which competencies and competitive abilities are important for market success?

Important competencies and competitive abilities for market success of Sanal Salt in the piston industry are the following:

- **Manufacturing:** Is there enough capacity in the present and the future? The manufacturing capacity of Sanal Salt is increasing this year and the coming years to address the needs of the customers.
- **Technology:** Is there a fit between customer need and the delivered goods from the supplier? Important factors in the sodium chloride piston rings are purity and quality of the sodium chloride. Salt without additives, sodium chloride that is free-flowing and perfect soluble in water. Under pressure sodium chloride can be compacted into a solid and strong form. Sodium chloride as a chemical is very stable product (melting point of 801°C and a boiling point of 1465 °C), suitable for metallurgy and casting of aluminum.
- **Marketing:** The ability of Sanal Salt to create value for piston companies and other metallurgy and casting companies and AkzoNobel itself. To provide customers with solutions and create a strong, long term relationship and technical service.

Suppliers

Normally AkzoNobel is a basic chemical supplier for other customers. This fact also applies to the sBU Salt Specialties and the various product groups. So in the case of Sanal Salt in the automotive and metallurgy industry extra information about suppliers is not necessary. But when Sanal Salt is used in food or healthcare applications additional information of other suppliers is needed. This was also needed in the case of 'Loso OneGrain', here AkzoNobel needed information of the royal Dutch State Mines (DSM) about what specific product characteristics are of the minerals and supplements that are attributed to 'Loso OneGrain'. Additional information about other suppliers is also checked, this way an optimal choice can be made about which suppliers best suit the opportunity and result in the best value co-creation.

Government Policies

Governmental policies are also important in recognizing new opportunities. Governmental policies can influence opportunities in positive and negative ways. Therefore it is important to know how legal and governmental forces are influencing the industry.

The following data about China and its regulations concerning the automotive industry is extracted from APCO Worldwide:

(http://www.export.gov.il/uploadfiles/03_2012/chinasautomotiveindustry.pdf)

“China became the world’s largest automobile producer and market in 2009 with annual sales of nearly 14 million vehicles. The market continues to expand in 2010. In the first nine months of 2010, automobile production reached 13.08 million units, a 36.1 percent increase from a year ago. The China Association of Automobile Manufacturers (CAAM) raised its forecast for annual sales to reach a record 17 million this year, matching the highest annual total ever reached in the United States.

- *Industry growth has been primarily driven by rising domestic demand stemming from rising incomes, a growing middle class, and by supportive industry policies from the Chinese government.*
- *The Chinese automotive industry remains very fragmented. In addition, Chinese central government officials fear that unchecked expansion of China’s auto industry encouraged by local authorities could harm the wider economy, and that excess capacity must be stopped. Hence, the central government continues to push for mergers and acquisitions (M&A) in the automotive industry which will support the emergence of a few leading national companies.*
- *China’s weak R&D, domestic innovation and design capabilities are key challenges to its international competitiveness. With the government’s encouragement, domestic firms have opted for strategic partnerships with foreign players, aiming to facilitate technology transfer and improve domestic design and engineering capabilities.*
- *The Chinese government has implemented a number of tax adjustments and subsidies for automobile purchases to encourage hybrid electric vehicles, pure electric vehicles and traditional vehicles of small engine displacement.*
- *Beijing has gradually introduced higher automobile emission standards for new vehicles. Plans to develop hybrid electric and pure electric vehicle production capabilities are part of a broader, environmentally friendly strategy to develop the auto industry.*
- *Market opportunities exist especially in the following areas: Developing domestic innovation capabilities (e.g. vehicle design and engineering, hybrid electric and pure electric engines, electric motors and electric controls). Productivity and quality upgrade (e.g. engines, transmissions, electronic control systems and safety systems) Mergers and acquisitions. Clean transportation technologies. Advanced manufacturing technologies*
- *Supply of essential automotive components/systems to OEMs (e.g. electronic control systems and safety systems)*
- *The following automotive segments in China are considered to be highly competitive and it will likely be difficult for Israeli firms to penetrate the market unless they have an extreme competitive advantage: Fabric for seats/interiors, seat covers, floor mats, curtains, aluminum die casting, rubber bumpers, electronic harness cables, antennae, speakers, electric starters, vehicle cleaning products, window films, A/C compressors, fuel and oil and air filters. “*

The data in the section below is about the vision of automotive policy of the government of India and derived from www.siamindia.com/scripts/auto-policy.aspx.

“This policy aims to promote integrated, phased, enduring and self-sustained growth of the Indian automotive industry. The objectives are to:

- *Exalt the sector as a lever of industrial growth and employment and to achieve a high degree of value addition in the country.*
- *Promote a globally competitive automotive industry and emerge as a global source for auto components.*
- *Establish an international hub for manufacturing small, affordable passenger cars and a key center for manufacturing Tractors and Two-wheelers in the world.*
- *Ensure a balanced transition to open trade at a minimal risk to the Indian economy and local industry.*
- *Conduce incessant modernization of the industry and facilitate indigenous design, research and development.*
- *Steer India's software industry into automotive technology.*
- *Assist development of vehicles propelled by alternate energy sources.*
- *Development of domestic safety and environmental standards at par with international standards.*

SIAM welcomed the announcement of Auto Policy and feels that the policy would serve as a reference document for all stake holders and other interested parties.

The Auto Policy has spelt out the direction of growth for the auto sector in India and addresses most concerns of the automobile sector, including:

- *Promotion of R&D in the automotive sector to ensure continuous technology up gradation, building better designing capacities to remain competitive.*
- *Impetus to Alternative Fuel Vehicles through appropriate long term fiscal structure to facilitate their acceptance.*
- *Emphasis on low emission fuel auto technologies and availability of appropriate auto fuels and encouragement to construction of safer bus/truck bodies - subjecting unorganized sector also to 16% excise duty on body building activity as in case of OEMs*

The policy has rightly recognized the need for modernizing the parc profile of vehicles to arrest degradation of air quality. The terminal life policy for commercial vehicles and move toward international taxing policies linked to age of vehicles, are steps in the right direction.

SIAM has always been advocating encouragement of value addition within the country against mere trading activity. However, this aspect has not been fully addressed. The Auto Policy allows automatic approval for foreign equity investment up to 100% in the automotive sector and does not lay down any minimum investment criteria.

The recommendation of promoting passenger cars of length up to 3.8 meters through excise benefits is not in line with the free market concept and may lead to market distortion.

However, with the Auto Policy in place, the automotive industry would get further fillip to become vibrant and globally competitive. The industry would get the required support from other Ministries and departments of Government of India in achieving the goals laid down in the auto policy. “

Competition

If internal sources of prior knowledge can't give a clear view of the competition in the new application markets the following questions should be answered using external sources. Information about competitors in the automotive and metallurgy industry is less clear or simply not available yet for AkzoNobel.

How many competitors' classes are there and what is their relative market share?

The sodium chloride business in general is very competitive. There are many sodium chloride manufacturers worldwide. The webpage <http://salt-partners.com> gives an extensive overview of these manufacturers and their locations.

For the piston industry most manufacturers use domestic sodium chloride. The awareness of the advantages of Sanal Salt is not known to customers and end-users. Several internet sites like Made-in-China.com and Alibaba.com show that China alone has approximately around 50 manufacturers of sodium chloride. A conclusion that can be drawn from this data is that the market is in full competition.

How will the major competitors react to another player in the market?

Due to the high quality of Sanal Salt and the lower quality of domestic sodium chloride used in the piston and metallurgy industry, competitors will not react fiercely to this kind of competition in the beginning. Furthermore since the market form is already full competition, one extra competitor does not change the market rules when AkzoNobel enters the market.

Focus Areas

At the start focus areas are often very broad defined and include various fields of expertise and knowledge. By obtaining external information about industry networks and combining this with internal prior knowledge and information, certain focus should starting to exist which can be the starting point for participation in professional forums to elaborate the initial ideas. The focus area is the automotive and metallurgy industry and the application of Sanal Salt in this industry. But new questions arise, which country or countries cover the focus areas?

Customers and End-Users

Other external sources that can be used to recognize / identify new opportunities are customers and end-users. Questions that can't be answered with internal sources but that are important for successful opportunity recognition are described below.

Who are the customers and end-users? How many customers and end-users exist in the market?

Customers of the automotive and metallurgy industry and the application of Sanal Salt in this industry are piston manufacturers and vehicle manufacturing groups. End-users are people and companies that buy cars or engines. On the next page some customers are summed up, for the complete list of potential customers' appendix E can be consulted.

Piston manufacturers in China:

1. <http://www.mahle.com>
2. <http://www.tikparts.com/aboutus.php>
3. http://www.wo-tech.com.cn/index_gocontactus.action
4. http://www.goldtruth.com.cn/contact_service_en.asp
5. http://www.nbxus.com/en_lianxi.asp

Piston manufacturers in India:

1. <http://www.made-from-india.com/showroom/shriramintl/gallery.html>
2. <http://www.jaicylindrliners.com/>
3. <http://www.meenacast.com/contact.html>
4. <http://www.tandemhydraulics.com/profile.html>

Piston manufacturers Taiwan and South Korea:

1. <http://www.challengehardware.com.tw/about.htm>
2. <http://www.engimax.url.tw/Private/manage.htm>
3. <http://www.clizen.com/customer-support-contacts>
4. http://www.bat31.com/sub4_1_e.html

Top vehicle manufacturing groups:

1. Toyota Motor Corporation
2. General Motors Company
3. Volkswagen Group AG
4. Hyundai Motor Group
5. Ford Motor Company

What are the key requirements of the customers and the end-users, what do they expect?

Knowing that the cost of a single defective component is far higher in the casting part of the process because of material cost, casting processing costs, energy used and the cost of all preceding processing steps, than in the first stages of production of the ring, the lower the defective figure in the casting process is most probably by far most important from an economical point of view. The purity of Sanal Salt is critical for a successful casting process.

For end-users it is important that the volume of engines becomes smaller due to economical and environmental global reasons. This means that the temperature and pressure of engines becomes higher in engines, hence internal cooling becomes even more important. Smaller engines are less heavy and that translates into more energy friendly engines.

Mentors

Mentors have additional experience in same and / or different markets which result in extra absorptive capacity for individuals and / or teams. External mentors are teachers or external colleagues. In order for mentors to be useful for individuals and teams, reciprocal communication and information sharing which results in extra absorptive capacity between a mentor and the individual employee should take place periodically. The sBU Salt Specialties is in need of external mentors for the application of Sanal Salt in the automotive and metallurgy industry. During this study the researcher was able to establish a new contact with the general manager of Rubitech Alucast. This company has rich information about core free casting processes, possible new markets and products where Sanal Salt can be applied. As stated above, this information could result in extra absorptive capacity for AkzoNobel and the sBU of Salt Specialties. Action should be taken by the sBU Salt Specialties and its employees to deepen communication with this mentor, because new opportunities could be recognized during these contact sessions.

9. Conclusion

This research consisted of designing an Innovation Process Model (IPM). The building blocks of the IPM were derived from scientific theory and practices of the organization of AkzoNobel. The validation of the IPM was focused on the application of Sanal Salt in the automotive and metallurgy industry. The central research question of this thesis was formulated as followed;

What Innovation Process Model consisting of internal and external sources of knowledge enhances the absorptive capacity of individuals and teams, which is critical for a structured process of opportunity recognition, value co-creation and the creation of new business?

The findings of this thesis obviously illustrate that there are fits and gaps between the scientific theories and the practices of AkzoNobel. Furthermore the findings showed that the building blocks of the IPM can be separated in internal and external sources of knowledge.

Internal sources of knowledge are defined as sources that are hard, focused and closely aligned to operational requirements. Important factors in the management of internal sources of knowledge are acquisition, storage and maintenance. The internal sources of knowledge of the IPM consist of five major factors namely;

1. General industry knowledge
2. Special interest knowledge
3. Information and communication channels
4. Product specific characteristics
5. Use of mentors

Each major factor can be shown in more detail, which is useful for the process of opportunity recognition, value co-creation and creating new business.

External sources of knowledge are defined as information external to the organization. External sources are more difficult to manage than internal sources, because analysis and interpretation are essential to determine the value, relevance and usability. Instead of being valuable at a daily basis, external sources are valuable at a strategic basis. The external sources of knowledge of the IPM consist of three major factors namely;

1. Participation in professional forums
2. Information of industry networks
3. Use of mentors

Here also each major factor can be shown in more detail which is useful for the process of opportunity recognition, value co-creation and creating new business.

The starting point of the IPM consists of absorptive capacity of the organization. This entails the ability to exploit internal and external knowledge. This prior knowledge includes basic skills and recent technological and scientific developments in the field. 'Prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm's absorptive capacity', Cohen & Levinthal (1990). So in a matter of fact absorptive capacity of individuals and teams constitutes to the process of opportunity recognition, value co-creation and the creation of new business. This absorptive capacity of individuals and teams consists of internal and external sources of knowledge.

The major factors of internal and external sources of knowledge are consisting of information and communication processes. These sources play a crucial role in absorptive capacity and a structured process of opportunity recognition, value co-creation and the creation of new business.

So to conclude, the IPM is an Innovation Process Model that helps individuals and teams to recognize new opportunities. The IPM addresses the problem of ad hoc opportunity recognition, because it is structured process that identifies solutions for new opportunities by using internal and external sources of knowledge. Last but not least, applying the IPM has short term, middle term and long term implications for the organization and its policies. These implications are elaborated in chapter 10.

10. Recommendations

The recommendations of this study are three folded namely;

- Short-term, these recommendations can be implemented as soon as possible and cover the next six to nine months.
- Middle-term, these recommendations can be implemented as soon as possible and stretch along the next 12 to 18 months.
- Long-term, these recommendations should be further investigated and contain a planning for the coming 24 to 36 months.

The recommendations entail the following steps:

- Firstly a statement is given of what specifically should be done and what resources are needed to implement the policy.
- Secondly a discussion takes place about the benefits for the organization. What problems would be corrected or avoided.
- Thirdly a discussion takes place about the feasibility of the proposed policy.
- Last but not least a general statement is given about the nature and timing of an evaluation plan. This evaluation plan is used to determine the effectiveness of the proposed policy.

A general point of attention for the recommendations is that most of the recommendations are also applicable for other applications of Sanal Salt, for instance pharmaceutical, healthcare and food applications. Furthermore the recommendations are given in the light of significant expansion and acceleration in growth of AkzoNobel's pharmaceutical salt business.

10.1 Short-Term Recommendations

Additional Knowledge of Markets

The sBU Salt Specialties should start collecting additional knowledge of the markets of sodium chloride piston rings and other metallurgy applications for sodium chloride. Resources that are needed for gathering additional knowledge are internet, e-mail, telephone calls, documentation formats and an educated individual that is focusing on this task and handles the needed resources. At the moment market development and technical service and sales managers are too much occupied with other operational tasks. After six to nine months the documentation about the market can be evaluated.

Additional Knowledge about Potential Customers

The sBU Salt Specialties should gather additional knowledge of customer needs and ways to serve the customers in the piston and metallurgy industry. Again resources that are needed for gathering additional knowledge are internet, e-mail, telephone calls, documentation formats and an educated individual that is focusing on this task and handles the needed resources. A short list about the most common problems and needs of customers along with solutions creates extra value for the sBU Salt Specialties. Furthermore prioritizing potential customers in for instance potential growth and current consumption of sodium chloride is a logical step. At the end of these nine months a (potential) customer database should be available.

Newspapers, Magazines and Trade Press

Reading of newspapers, magazines and trade press about the automotive and metallurgy industry. These forms of extra absorptive capacity are a stimulus for opportunity recognition, value co-creation and in the end for the creation of new business. Although AkzoNobel has pointed out special individuals that can access trade press and professional magazines, it is not always clear to other employees who to these special individuals are. But the most important issue of this external source is getting individuals and teams to read and apply these external sources periodical. Knowing what is happening is the start of opportunity recognition. After six months a database of interesting trade press should be available for all employees in the sBU of Salt Specialties.

Use of Intranet Websites

The use of the intranet websites of AkzoNobel should be used more extensive by the employees of the sBU Salt Specialties. It is another way to get more information and it can support the creation of an effective network between various sBU's and BU's. In the case Sanal Salt and the application of the product in the automotive industry, the intranet can be a starting point to get more information. New networks can originate with other sBU's that also require information or are in possession of interesting information about the automotive industry. After a period of six to nine months the first benefits of using the intranet more extensively should be visible.

Use of Internet Websites

Next to gathering information and knowledge, internet is also a valuable tool for sharing information and knowledge. Internet websites are crucial to get in contact with potential customers. During the research of this thesis the following came to the attention of the researcher. Although AkzoNobel is a large company, the company isn't displayed on the first page on Google when people search on the term 'salt' or 'sodium chloride'. This gets even worse when you use the term 'zout' the Dutch translation of sodium chloride. In Dutch, AkzoNobel is only for the first time visible on page five of Google. The same applies to the case of pharmaceutical salt. This is a lost opportunity to get more often in contact with possible customers. To be in the top rankings of search engines like Google.com is an important factor for organizations to get publicity and acquaintance with potential customers. For the sBU Salt Specialties and for the product of Sanal Salt it is important to get this publicity and acquaintance in combination with the piston / automotive and metallurgy industries.

The next step in using the internet as a sharing tool for information is the structure of the internet site. For front-end stages of new product development processes suggestion boxes and virtual communities are valuable tools to improve the ideation and concepts of new opportunities. The internet site of Sanal Salt does not have one of these tools yet. A recommendation for the next six months is to get in touch with a web-designer and realize transformations which are addressed above.

Corporate Newsletters

Focusing on the products of Sanal Salt reveals another missed chance in sharing information. The products and developments are seldom or never mentioned in global, country and local magazines. Especially possible new applications and trends of Sanal Salt should and could be pushed more into the organizational publicity. Publicity and acquaintance within the company itself can generate new ideas and suggestions for the product of Sanal Salt and for the sBU Salt Specialties in general. This recommendation only needs time and effort as resources to be effective. After six months an evaluation can take place. Examples of evaluation are the amount of comments on publications in corporate newsletters by AkzoNobel employees and the amount of new contacts and new ideas.

Use of Mentors

In the case of the product Sanal Salt perhaps mentors can be found in other parts of the organization. It seems logical to assume that mentors can be found in the BU of Automotive and Aerospace Coatings, who can support the sBU Salt Specialties and the product group of Sanal Salt with additional information about the automotive and metallurgy industries. The resources which are needed for this recommendation is an individual spokesman that forms and maintains new networks and documentation of contact persons for various applications of Sanal Salt.

Conferences and Conventions

For AkzoNobel, the sBU Salt Specialties and specifically for the product group Sanal Salt, these conferences and conventions should be based upon particular industries or industry segments. In the case of the piston sodium chloride rings these segments are: piston, engine, automotive metallurgy and casting industries. In chapter 8 a small start has been made with possible conferences and conventions for the sBU Salt Specialties. Of course more conventions and conferences can be traced on the internet. The resources needed for this recommendation is time, money, transport and individuals within the sBU who undertake these conferences and conventions. Knowledge and information absorbed during these meetings should be shared among other members of the sBU, preferable in reports and in meetings. Within six months reports and meetings should increase the absorptive capacity of the sBU.

Internet Communities

The sBU Salt Specialties should use internet communities to communicate and meet with possible new customers. For the sBU Salt Specialties and the product group of Sanal Salt a small start in the tracing of websites and communities online has been made. These are described in more detail in chapter 8. Internet communities are effective tools for gathering knowledge and sharing knowledge to potential customers. Resources that are needed for using internet communities as tool are an individual who tracks certain trends of certain communities and a documentation or report system to share knowledge to other team members of the sBU Salt Specialties. A start can be made for using internet communities on a weekly basis and an evaluation of the set up phase should be realizable after the first six months.

Collecting Information about the Competition

Internal sources of prior knowledge can't give a clear view of the competition in the new application markets. External sources should be used to gather information about competitors in the automotive and metallurgy industry. Data of competitive sodium chloride manufacturers in particular markets should be collected put into a database. Next to sodium chloride manufacturers also manufactures of substitutes should be pin-pointed.

Start up knowledge collection of industry related technologies

Currently the sBU Salt Specialties needs to start using external sources to search to satisfy perceived lack of knowledge and to evaluate the nascent ideas. Questions that can't be answered with internal sources should be answered using external sources. It is very important to find answers to the following questions in order to get a successful opportunity recognition and value co-creation which in the end should result in new business creation.

- What are the most important economic forces driving this industry in the present and in the future?
- What are the most important technological forces driving this industry in the present and the future?

- Which competencies and competitive abilities are important for market success in the present and the future?

These questions are partially answered in chapter 8, but research about these questions should be ongoing, because they affect the daily operations and future strategies of the SBU. Resources that are needed to find answers on these questions are explained in the previous short term recommendation points. After six months more information should be available which can be used to evaluate the questions from above.

Work out Focus Area(s)

The information from the short term recommendations supports efficient and effective decision making about choosing a precise focus area or focus areas. This is important for the planned increase in output of Sanal Salt from 2012 till 2014. After six to nine months a clear view of specific focus areas should exist.

10.2 Middle-Term Recommendations

Publishing in Newspapers, Magazines and Trade Press

Publishing in newspapers, magazines and trade press has a push and pull component which both address opportunity recognition. Publication of Sanal Salt and product specific characteristics can also be the starting point of new opportunities and value co-creation. Other businesses could be able to integrate their absorptive capacity with the technology of Sanal Salt. Hence, open innovation can occur by publishing general information of product specific characteristics and applications.

Before the sBU materializes the idea of publishing in trade press the sBU could use publishing in corporate newsletters as a stepping stone and sounding board. Resources that are needed for this recommendation are money for publishing and time and effort to create a clear text for the designated focus areas. Several months after publication an evaluation can take place about the expected and the actual effects of the publications.

Create an Idea Bank

An idea bank improves the ideation process which is described in the innovation funnel model of AkzoNobel. The reason that the idea bank is separately mentioned from the CoP states the importance of the concept. The sBU Salt Specialties is in need of a storage system for new ideas, which is easy accessible for every employee within the organization. Idea banks support innovative working behavior and nurture an organization's culture of innovation. It results in cost savings or a rapid gain in revenue. In order to make an idea bank successful, scores have to be given in various topics of the new ideas. After 12 to 18 months the idea bank should have enough product concepts for Sanal Salt and due to the scores that have been given for every idea, employees are able to choose the most promising ideas.

Start using a CoP

What is remarkable is that there is no alternative CoP for Salt Specialties. A CoP for Salt Specialties could certainly help to recognize and identify new opportunities. A global network of experts and practitioners sharing knowledge and expertise in order to achieve strategic advantage by creating added value and innovations across Salt Specialties is a big step forward. The biggest benefits for Salt Specialties to introduce a CoP model are the following:

- Problems solving with reduced time and costs
- Improving, speeding up projects by synergies and sharing best practices
- Identification of new opportunities

A well established CoP model in practice for Salt Specialties should consist of the following actions; these actions are directly derived from the intranet website of AkzoNobel.

- Core team meetings
- Special interest teams (working groups)
- Inter-BU contacts & interactions
- Discussion forum
- Source of knowledge
- Expertise
- Best practices
- WebEx presentations (Webinars)

To implement the CoP the following steps should be taken. The first half year starts with a kick-off, a website has to be generated for discussion and information forums. Furthermore an inventory must take place for Salt Specialties technologies. Also an overview of R&D projects on Salt Specialties should be generated and a newsletter should be written on a monthly basis. Last but not least in the first half year of the CoP implementation the focus should be on fast growth of the number of members.

In the second half of the first year, clear goals and strategies should be stated on the website. Furthermore the focus should be on knowledge exchange on specific Salt Specialties subjects. Also active discussion forums should be a point of focus, members are crucial here. Last but not least obtaining results and reviewing results should take a central place in this period.

In the second year gap analyses should be performed. Technology and market gaps concerning Salt Specialties should be analyzed for each business / category group within Salt Specialties.

Furthermore during the gap analyses, proposals should be given for approaches, solution concepts and strategic decisions. Also a start has to be made with challenging workshops and webinars.

Last but not least more explicit contacts have to be made with BRIC countries which are viewable for the CoP. This creates additional value to the sBU Salt Specialties. To conclude the CoP can be a source of technical and market information for the sBU Salt Specialties. It is a valuable toolkit for gaining and sharing knowledge and experience. It increases the network capacities and the reputation of the sBU.

Maintain use of Mentors Internal and establish Mentors outside the Organization

Mentors have additional experience in same and / or different markets which result in extra absorptive capacity for individuals and / or teams. External mentors are teachers or external colleagues. In order for mentors to be useful for individuals and teams, reciprocal communication and information sharing which results in extra absorptive capacity between a mentor and individual should take place periodically. In the case of Sanal Salt and the application of the product in the automotive and metallurgy industry, new contact persons have to be found outside the organization. A first step has been made in the chapter 8 of this thesis. Maintenance and momentum are crucial in the use of mentors that are able to support opportunity recognition. That is why in the coming 12 to 18 months employees should focus on this recommendation point at least on a monthly basis.

Workshops and Trainings

Workshops and trainings are good ways to generate new ideas and to expand absorptive capacity by increasing the current knowledge database of individuals and team members. New opportunities often reveal themselves after workshops and trainings. Workshops and trainings not only produce new ideas, they also enhance communication and teambuilding. In order to optimally use workshops and trainings a shortlist of beneficial workshops and trainings for the organization should be created. Chapter 8 gives an overview of beneficial possibilities. Focus points of workshops and trainings are:

- Idea generation and conceptualization of ideas
- Customer needs and problems
- Culture and manners about contacts with BRIC countries
- Workshops about trends in automotive and metallurgy industries

After 12 to 18 months at least one or two workshops and trainings should have been followed by employees of the sBU of Salt Specialties, especially by the employees that have core tasks that enfold the product of Sanal Salt. Beneficial knowledge and information that is obtained during these workshops and trainings should be documented and shared within the sBU Salt Specialties.

Follow Seminars

Before the sBU Salt Specialties decides that seminars can be useful to help find new opportunities for specific product groups, they have to be certain that the prior knowledge level of individuals is high enough to participate. Trainings and workshops can elevate this level. Topics for useful seminars are the same as those for workshops and trainings.

Stay updated about Conferences, Conventions and Internet Communities

The conferences, conventions and internet communities that are mentioned in the short-term recommendations must be maintained and updated. An agenda should be created where valuable and useful upcoming events are registered and shared with other employees and team members. Documentation of the agenda must be precise and should contain the following data:

- Topic
- Time
- Place
- Goals
- Costs

Collaboration with Universities in combination with Knowledge about Government Policies

Another external source that can be used to recognize / identify new opportunities is collaboration with universities. AkzoNobel has some of these collaboration pacts with universities around the globe. For instance, in the Netherlands AkzoNobel collaborates with the University of Wageningen for agriculture business. In the case of opportunities for sodium chloride products and especially pharmaceutical salt, the sBU Salt Specialties could contact several universities in the Netherlands. Collaboration with universities can focus on several areas which are described below.

- Business development
- Technical development
- Market development
- Governmental policies around the globe

Of course these areas can be even more focused to help the sBU Salt Specialties to develop new ideas in corporation with students of universities. At least one employee of the product group of Sanal Salt should make an action plan of what precisely can be gained for the organization through collaborations with universities. This action plan should be started up in the next 6 months and a clear evaluation could take place after 18 months. Next to these focus areas additional opportunities can be identified in the form of creating a useful networks for future events and staying up-to-date with developments in science.

10.3 Long-term recommendations

Maintain General Industry Knowledge and Information of Industry Networks

To stay up-to-date about general industry knowledge and information of industry networks, maintenance of the short-term recommendations is crucial. This should take place on a weekly to monthly basis. Also the middle-term recommendations are important and should be maintained in a monthly basis. Industries and networks continuously change and adapt to environments and new technologies. The only way to stay up-to-date is to be active in these arenas. Employees and teams should know this and stay focused. Of course daily operations are important and need to be executed successfully, but long-term strategic goals must be kept in mind. These strategic goals are derivatives of industry knowledge and networks. In order to be successful in the long-term, product groups like Sanal Salt, must maintain general industry knowledge and information of industry networks. Communication and information sharing is therefore crucial. The creation, implementation and maintenance of information and communication channels described in the short-term and middle-term recommendations are useful tools to realize these strategic goals.

Maintain Entrepreneurial Alertness and Individual Innovative Behavior

The starting point of the IPM consists of absorptive capacity of the organization. This entails the ability to exploit internal and external knowledge. This prior knowledge includes basic skills and recent technological and scientific developments in the field. 'Prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm's absorptive capacity', Cohen & Levinthal (1990). So in a matter of fact absorptive capacity of individuals and teams constitute to opportunity recognition and value creation. This absorptive capacity of individuals translates to entrepreneurial alertness and individual innovative behavior. Entrepreneurship involves the discovery of opportunities and the resources to exploit them as the economy moves towards equilibrium. Individual innovation starts with problem recognition and the generation of new ideas and solutions to address the problem. The IPM is not only an effective and efficient tool to create employees and teams that are innovative and entrepreneurial; the IPM also maintains this type of behavior.

11. Limitations and Discussion

After presenting the interesting and important findings in the chapters 5, 6, 7, 8, 9 and 10 it is necessary to put these findings into perspective. This chapter gives an overview of the limitations and implications of this research study for science in general, practices in a broader perspective and suggestions for further research.

11.1 Limitations

The limitations of this study can be divided into methodological limitations and limitations of the researcher. Claiming limitations is a subjective process because of the evaluation of the impact of those limitations.

Methodological Limitations

- Sample size: The number of the units of analysis used in this study is dictated by the type of research problem that is investigated. The units of analysis are diverse in this study, since this case study is characterized as a design study. For the practices of AkzoNobel regarding opportunity recognition mechanisms the sample is large enough due to several interviews and documentation that was found on the intranet. Furthermore the company of AkzoNobel is very large and diverse, which gives certain richness to the sample size. Though there is an opportunity to do further research about best practices of opportunity recognition outside the company of AkzoNobel. In the end stage of this study the researcher tried to interview companies that are known for progressive processes of opportunity recognition, value co-creation and creation of new business. But companies like 3M and BASF were not able to participate due to confidential reasons. For this research the sample size is correct, the negative effects of self-reported-data by interviewees are diminished by sample size and sample richness. It results in robust findings and enables solid conclusions. Generalization of the study is at least possible within the organization of AkzoNobel and probably also within other companies.
- Lack of available and/or reliable data: The lack of available data is certainly a limitation of this research so far. For instance information about the piston market, customers and their needs and problems takes time to become solid information. Most data about these topics is based on future developments. This became clear after numerous telephone interviews. Furthermore the reliability of this data is also not always clear, due to language barriers and the level of knowledge of the interviewees about key elements of the. Future research should focus on typical market research elements about the market size and its customers' needs and problems. A massive market survey would be a very useful tool. The goal of this study is that opportunities are being recognized in a structured manner.

Limitations of the Researcher

- Access: This study has an access problem to get in contact with the right people. The problem was displayed several times during the validation of the IPM. Engineers, technicians and other people with knowledge about the piston production where only able to speak Chinese. This limited the chance to get the right information about potential new customers in China. Translating questions in the Chinese language guarantees more and better results in future research about markets and customers.
- Longitudinal effects: The time to investigate the central research problem (design, implementation and evaluation) is constrained by the due date of the assignment. The topic required an excessive amount of time to complete the literature review. Lots of information about opportunity recognition, value co-creation and creation of new business makes it difficult to focus. Future research could specifically focus on one or two building blocks of the IPM. In the section recommendations short term, middle term and long term focus is prioritized.

11.2 Implications for the Field of Science

This research study aimed to design an Innovation Process Model that relates internal and external sources of knowledge which enhance the absorptive capacity of individuals and teams. This absorptive capacity is critical for a structured process of opportunity recognition, value co-creation and creation of new business. From a scientific point of view, the design of this model creates an overview of valuable and useful information about internal and external sources of knowledge in relation with the concept of absorptive capacity, which results in a structured process of opportunity recognition, value co-creation and creation of new business.

Discussing the implications for the field of science should address the concepts of novelty and consistency.

Concerning the concept of novelty, this research brings for the first time a diversity of knowledge sources together. These internal and external sources are triggers and social integration mechanisms for opportunity recognition, value co-creation and the creation of new business. Realization of internal and external sources of knowledge allows organizations a creation of competitive advantage and potential absorptive capacity provides organizations with strategic flexibility to reconfigure and change organizational operations, which allows organizations to survive. Though the concept of absorptive capacity is not a novel concept, the collection of possible sources of knowledge under one umbrella is. Unfortunately the creation of this umbrella leads also to new questions.

Questions concerning consistency are for example: Which sources of knowledge have the largest impact on firms' processes of opportunity recognition, value co-creation and the creation of new business, in other words, is there a need to prioritize sources? Is the umbrella that contains these sources of knowledge applicable for every type of organization, for instance service organizations, web shops and nongovernmental and governmental organizations?

So to conclude, this research does have implications for the field of science. Although the concept of absorptive capacity in combination with Innovation Process Models is not novel, the concept itself does not stop to interest researchers and business professionals. The quest to elucidate this phenomenon continues.

11.3 Implications for Organizational Practices

The implications of this study for AkzoNobel and the sBU Salt Specialties entail changes in information systems, organizational structures and organizational culture. The IPM is a new, overall and complete approach for the process of opportunity recognition, value co-creation and the creation of new business.

The IPM consists of a multitude of internal and external sources of knowledge, which can be used by the organization to identify new business opportunities and develop these opportunities further into actual new business.

The implementation of the PIM not only displays and explains the Innovation Process Model, the implementation also delivers new leads for new applications for the product of Sanal Salt. Furthermore this thesis delivers focus points for future research for the products of Sanal Salt and the IPM is a useful tool for decision making concerning future events. The institute of AkzoNobel Networked Innovation (ANNI) should integrate the IPM and facilitate the model throughout the organization.

11.4 Suggestions for further research

In paragraph '11.2 Implications for the Field of Science' some questions already surfaced that implicate further research options. This paragraph elaborates further on these options.

First of all it is useful to get a clear picture about the necessary individual and team capabilities that support the absorptive capacity of firms. Clarification caused by describing these personal characteristics allows organizations to hire, train and maintain more suitable individuals and teams.

As a result these individuals and teams are more effective and efficient to enhance the absorptive capacity of firms.

A second suggestion for future research is to measure capabilities over time, instead of cross sectional. It enriches the literature about absorptive capacity and internal and external sources of knowledge.

The suggestion above addresses another suggestion for future research, namely sources of knowledge and absorptive capacity must be measureable. Making internal and external sources of knowledge measureable makes it easier for firms to relate realized absorptive capacity with potential absorptive capacity. An example of a measureable source of knowledge is a cost/revenue ratio for workshops and trainings.

Last but not least if internal and external sources of knowledge and a firm's absorptive capacity are measureable, researchers are able to start a study that prioritizes the internal and external sources of knowledge. By prioritizing these sources of knowledge an optimum exist in which a firms absorptive capacity is maximum beneficial for the process of opportunity recognition, value co-creation and the creation of new business.

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www.ihatedialysis.com (patients views about dialysis)

<http://renalweb.groupee.net/eve/forums> dialysis and healthcare)

<http://www.eng-tips.com> (metallurgy processes and development)

<http://www.alloyavenue.com> (metallurgy and chemistry)

www.triz-journal.com

www.handsonrapidinnovation.com

<http://nfteconnect.org> (teaching entrepreneurship)

http://www.prweb.com/releases/piston_rings_pins/engine_valves/prweb860284.htm

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Appendices

Appendix A: Glossary of Definitions of Key Concepts

Absorptive Capacity

In business administration, absorptive capacity has been defined as "a firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends". Antecedents are prior-based knowledge (knowledge stocks and knowledge flows) and communication. Studies involve a firm's innovation performance, aspiration level, and organizational learning. It has been said that in order to be innovative an organization should develop its absorptive capacity (Cohen and Levinthal, 1990).

Business Concept

The term business concept is usually defined as an opportunity which has been fully developed to include how specific products are produced and reach (with benefits) recognized customers (De Koning & Muzyka, 1999).

Internal and External Sources

Internal sources: Often defined as sources that are hard, focused and closely aligned to operational requirements. Important in the management of internal sources are acquisition, storage and maintenance.

External sources: These sources are often defined as information external to the organization. External sources are more difficult to manage than internal sources, because analysis and interpretation are essential to determine the value, relevance and usability. Instead of being valuable at a daily basis, external sources are valuable at a strategic basis (Swash, 1997).

Market Research

Market research includes application of activities for sensing, learning about, and understanding customers, competitors, and macro environmental forces in the market place (Kahn et al., 2006). Macro environmental forces include political factors, economic factors, social factors, technological factors, environmental factors and legal factors. Micro economical forces include customers, competitors, distributors and suppliers.

Technology

Technology refers to the theoretical and practical knowledge, skills, and artifacts that can be used to develop products and services as well as their production and delivery systems. Technology can be embodied in people, materials, cognitive and physical processes, plant, equipment, and tools. Key elements of technology may be implicit, existing only in an embedded form (e.g., trade secrets based on know-how). Craftsmanship and experience usually have a large tacit component, so that important parts of technology may not be expressed or codified in manuals, routines and procedures, recipes, rules of thumb, or other explicit articulations. The criteria for success regarding technology are also technical, rather than commercial. Technologies are usually the outcome of development activities to put inventions and discoveries to practical use (Burgelman et al., 2009).

Opportunity Development

The term opportunity development is described as follows: " 'opportunity development' best describes the process of opportunity recognition over time. Currently, researchers use the term 'opportunity recognition' to mean one of two things. First, opportunity recognition describes the specific 'eureka' experiences, when suddenly an idea crystallizes. Typically, it is the initial idea which is described as the moment of opportunity recognition (e.g. Hills, 1995). Other researchers

use opportunity recognition to describe the evolution of initial ideas into full-blown business concepts (e.g. Bhavé, 1994). The distinctions are not always clear, leading to confusion. By using the term opportunity development, I am renaming Bhavé's second meaning of opportunity recognition, highlighting the evolutionary process. In fact, opportunity development probably includes several moments of sudden insight or opportunity recognition (De Koning & Muzyka, 1999).

Opportunity Development Process

The opportunity development process is defined as the evolution of a single opportunity idea to business concept (De Koning & Muzyka, 1999). The process starts with an idea and then goes to a process of reflection, discussion and research, alone and with other people. This process will then be developed and refined and change into a business concept.

Opportunity Recognition

Opportunity recognition describes the specific 'eureka' experiences, when suddenly an idea crystallizes. Typically, it is the initial idea which is described as the moment of opportunity recognition (e.g. Hills, 1995).

Building on these considerations, the process of recognizing opportunities can be defined as efforts to make sense of signals of change (e.g., new information about new conditions) to form beliefs regarding whether or not enacting a course of action to address this change could lead to net benefits (for instance, in terms of profits, growth, competitive jockeying, and/or other forms of individual or organizational gains). The outcome of this process lies in those subjective *ex ante* beliefs that an opportunity exists, or not, for the willing and able (Shepherd et al. 2007).

Process

According to Van de Ven and Poole (1995), the term process can be explained as a category of concepts of organizational actions, such as rates of communications, work flows, decision making techniques, or methods for strategy creation. In this research process entails organizational and informational components to identify business opportunities.

Process Innovation

Process innovation is the 'introduction of new production methods, new management approaches, and new technology that can be used to improve production and management processes' (Wang and Ahmed, 2004, p.305)

Portfolio management

Portfolios management represents the screening out of product concepts to identify the preferable product concepts with which to proceed (Product Development Management Association (PMDA) (2005).

Value Creation

The value creation process could be described as a spectrum ranging from core value, to added value, to future value. The value-producing potential of a supplier can be assessed reasonably well only in the case of the core value, where there is sufficient benchmarking information in the form of existing alternative offerings and solutions. A priori evaluation of the costs and benefits of added value and, especially, future value projects is problematic, because the realization of the value is dependent on the development of multiple partners, technologies and industries (Möller et al, 2009).

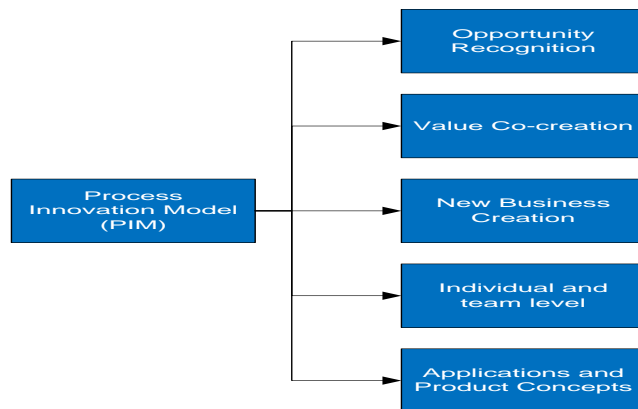
Value Co-creation:

Companies need to embrace a new approach to value creation, one in which the basis for value shifts from products to experiences; consumer influence is spread across the value chain (in research and development, design, manufacturing, logistics, service, and points in between); conflicts between companies and consumers are more visible and resolved more productively; and companies don't dictate how value is created.

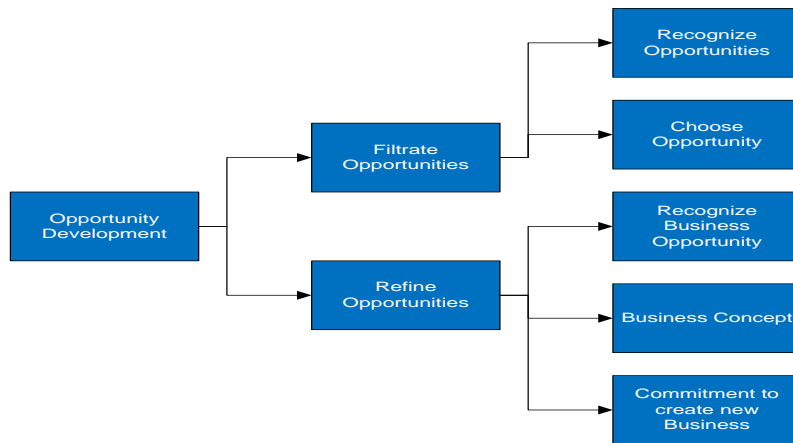
In short, companies must learn to co-create value with their customers (Prahalad & Ramaswamy, 2002). For Prahalad and Ramaswamy and others (see Tapscott and Williams, 2006) consumers have specialized competencies and skills that companies are unable to match or even understand. This suggests two special challenges for managers. Firstly, to attract and retain these consumers and secondly to provide a creative and open communications environment where such consumers qua workers can effectively apply and enhance their knowledge for the benefit of everyone (Tapscott, 1995).

Appendix B: Key definition trees

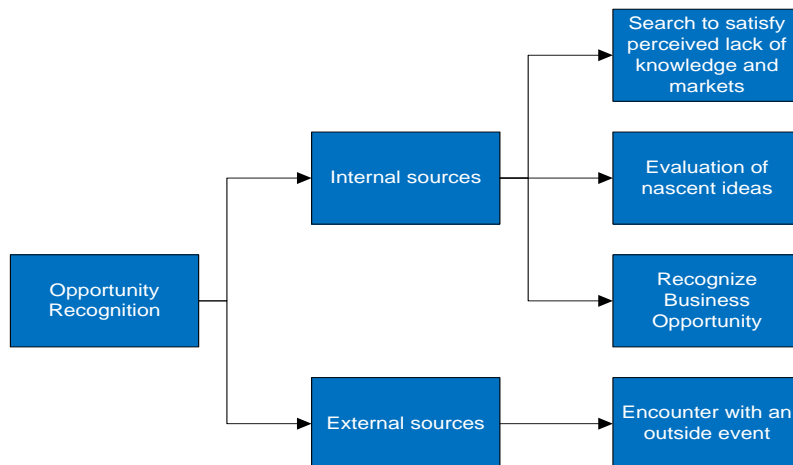
1. Composing of IPM



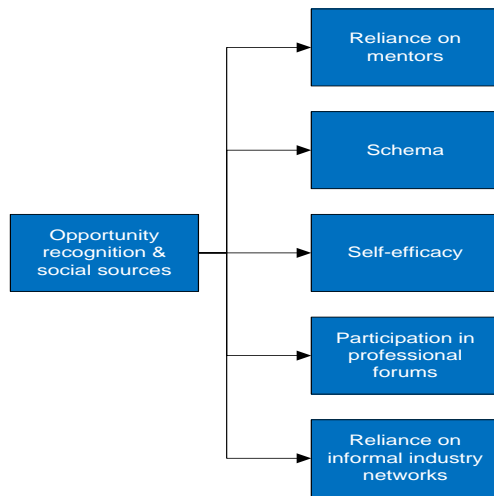
2. Decomposing of Opportunity Development



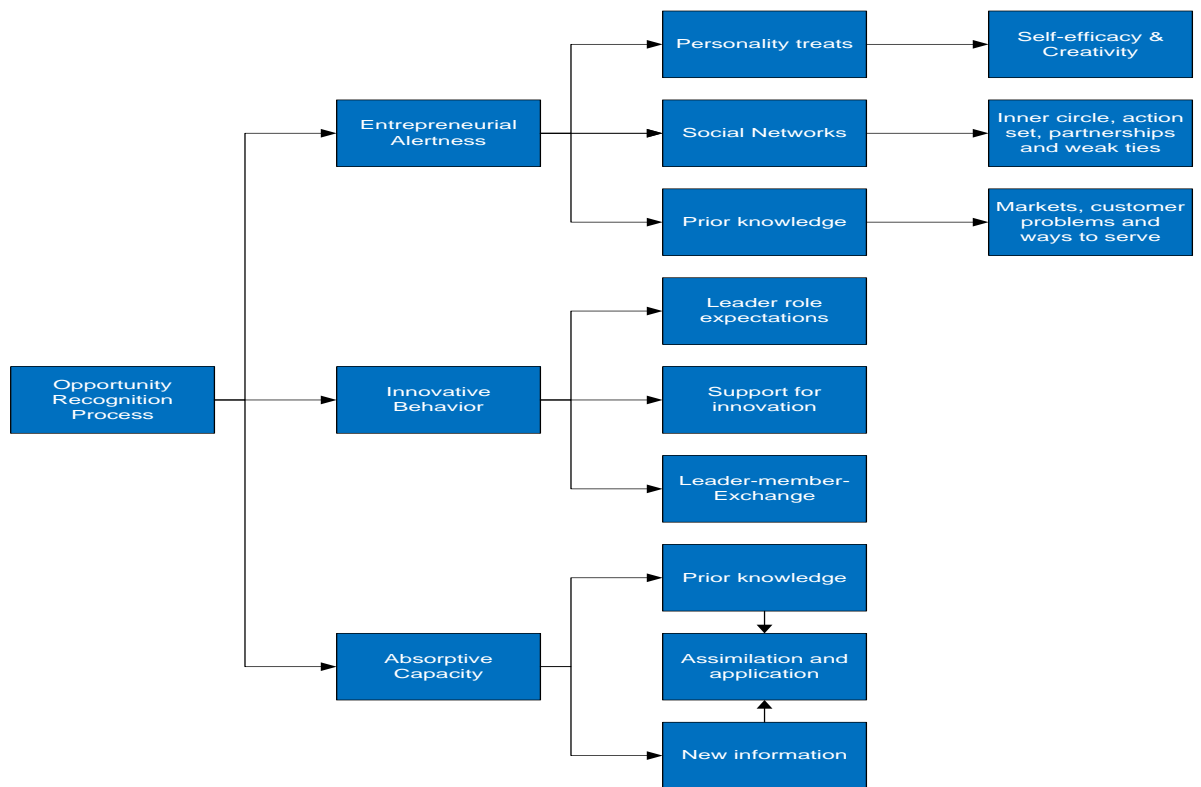
3. Decomposing Opportunity Recognition



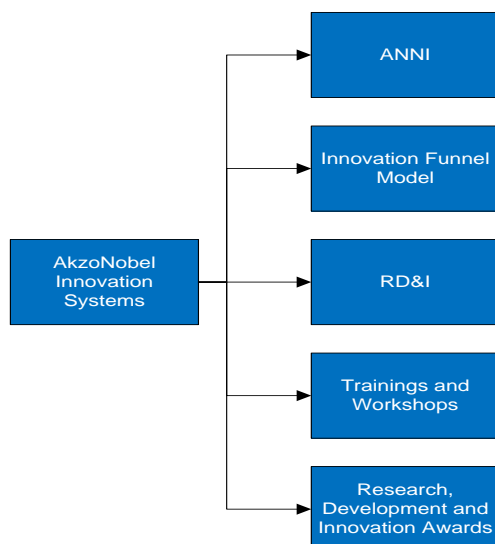
4. Decomposing Social Sources of Opportunity Recognition



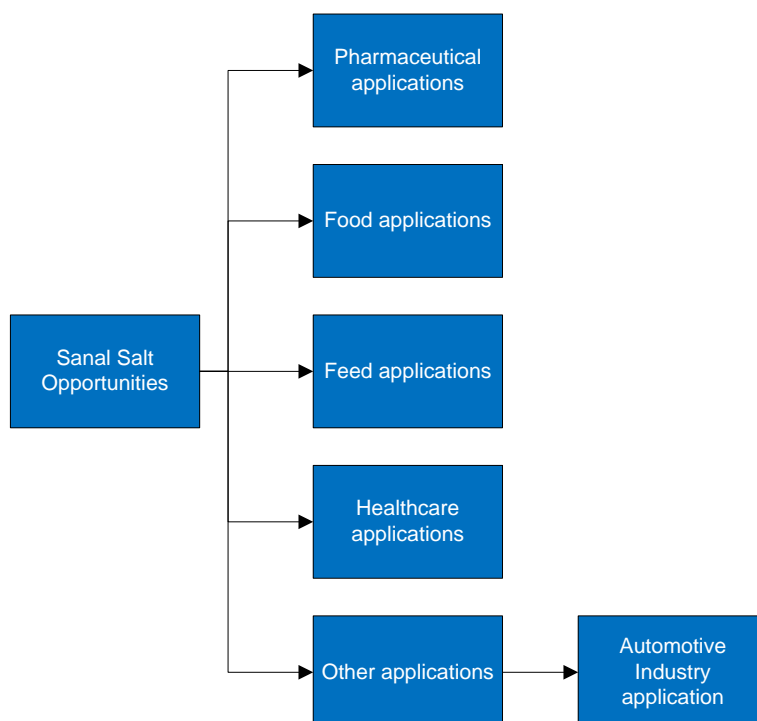
5. Decomposing the Opportunity Recognition Process



6. Innovation Systems of AkzoNobel



7. Composition of Opportunities of Sanal Salt



Appendix C: Interview Protocols

- **Name of interviewee:**
- **Name of unit of the interviewee:**
- **Function of the interviewee:**
- **Years in function:**
- **Date of interview:**
- **Time of interview:**
- **Contact info**
- **Telephone:**
- **Email:**

Introduction of myself:

Thanking for the willingness to participate in my research. Your opinion is very important and I am open for your thoughts and ideas.

Transcript:

This interview and the personal data will be handled with care. Is anonymity necessary for you? Is it okay if I send you the transcript of the analysis of this interview for verification? Then I know for sure that I have understood your opinion correctly.

Research question of my thesis:

The objective of this research is to design an Innovation Process Model that relates internal and external sources of knowledge which enhance the absorptive capacity of individuals and teams. This absorptive capacity is critical for a structured process of opportunity recognition (new ideas of technology applications), value co-creation (new product concepts) and creation of new business.

Core of the interview:

- Which models and methods are used by AkzoNobel for opportunity recognition, value co-creation and the creation of new business on an individual and team level? What internal and external sources of knowledge are used to support these models and methods?

Introduction Questions:

1. Could you start by telling me about your position within this organization?
2. How long are you active in this function?
3. Do you have a previous history in development and/or opportunity recognition?
4. What is it that makes your profession so attractive?
5. How would you characterize opportunity recognition within your unit? (technology push / market pull / combination)
6. How are development and opportunity recognition structured within the organization of AkzoNobel?

Internal Sources

1. Does the sBU understand the customer needs and problems? What are these? And how does this information reach the organization?
2. Have you ever helped to put a new product on the market (even if the original idea for the product itself was not yours)? What role did you play in this?
3. Is there a mentor for obtaining and interpreting opportunity relevant information? What roles do you think a mentor should have next to sharing extensive experience and additional knowledge?

4. How are the functions of thinking and talking about new ideas and opportunities structured inside in the business unit? Who are normally active in this phase and why?
5. High absorptive capacity is positive related to innovation. What does the organization do to increase of absorptive capacity of teams and individuals (prior and external knowledge that constitute to new ideas) and how is this structured?
6. Is the not-invented-here syndrome (avoid using or buying already existing products, research, standards or knowledge because of external origins) known within the organization? How is this diminished?
7. How is knowledge of markets and customers gathered, stored, maintained and accessed within this business unit?
8. How is knowledge shared within the organization and how is this guaranteed?
9. Does the organization support special interest knowledge of employees, if so how and what?
10. A central position in a network is positively related to innovation. How can the position of this unit be described in an intra-organization network? Is the current network position of this unit central, and if not how can this be accomplished?
11. Does an idea bank exist? If so what are the functions of this idea bank? Is it up to date and do people know where to find it? Do you know CoP and do you use this?
12. Does the unit know what is going on in other parts of the organization, concerning business development and opportunity recognition how is this done?
13. Are other units of AkzoNobel invited for opportunity recognition session in this unit (vice versa)?
14. Do you use internet and intranet to share ideas and come up with new opportunities?
15. How are corporate newsletters used in the business unit to gather, maintain and access new knowledge?
16. Is there a database for product specific characteristics and examples or ideas for which the products could be suitable?

External Sources

1. Are there examples of an encounter with outside events, which results in new ideas and opportunities? Is this structured in any way? How does information and knowledge reach the organization?
2. How is external knowledge exploited for opportunity recognition? And how is this related to prior knowledge?
3. Does the sBU built external networks and maintain them to support specialized knowledge?
4. Does the sBU work with other suppliers and / or customers to recognize new opportunities? Has this ever resulted in new business?
5. Are there actions in the organization that increase this prior knowledge? (workshops, forums, training programs, conferences, conventions, seminars etc)
6. How often are these actions taken during a year?
7. Are inner circle partners and networks of weak ties described and known to the organization and how are these chosen?
8. Do you and the sBU use external mentors to gain experience and additional knowledge? Who are these mentors or who could these mentors be?
9. Reliance on informal industry networks increases the chance of opportunity recognition. How can this fact be used for this unit (existing and potential customers, suppliers and other industry contacts)?
10. Does the organization cooperate with universities to gather new knowledge which can lead to opportunity recognition?
11. Do you as individual use internet communities to stay up-to-date in technology, industry and end-user changes?

12. Does the organization face the phenomenon of lock-out in certain fields (no investment in absorptive capacity in a quickly and new moving field), which causes non-opportunity recognition (for example energy storage).
13. What developments have you lately noticed in the industry and market of the organization? How have you used this information for new opportunities?
14. How does the organization obtain extra-industry knowledge and what choices are made prior and during obtaining this knowledge?
15. In what ways are governmental policies used in opportunity recognition and how are future trends spotted?
16. Central positions in a network are positively related to innovation. How can the position of this unit be described in its external network? Is the current position central and if not how can this be accomplished?
17. Are external sources used like publications in trade magazines or newspapers, to get more attention for the products, does this result in new opportunities?
18. Do employees read trade magazines, professional magazines etc. to expand knowledge, networks etc.
19. Does the organization organize conferences and conventions for customers, suppliers and other stakeholders?
20. Are there other ways used to inform customers/ possible customers about the special capabilities that this unit of AkzoNobel can offer them?

Extra Questions about Opportunity Recognition and Opportunity Development:

1. How is the decision of 'taking action' in opportunity recognition formed?
2. How is decided what resources are needed? And how is this approved? (financial, technical, knowledge, specialized information or legitimacy).
3. Do you know a unit within AkzoNobel that has a best practice for opportunity recognition or in other words is leading in opportunity recognition, value co-creation and creation of new business processes?
4. Are there any other aspects of opportunity recognition, value co-creation and creation of new business important in your opinion, what is the role in this for internal and external sources?

Appendix D: Questionnaire for Manufacturers of Pistons

Dear Sir / Madam,

My name is Bas van de Waal and I am working on a master thesis about a sodium chloride product. This product is called Sanal Salt and is produced by AkzoNobel. I am in the master phase of the study innovation management, which is generally a business administration study at the University of Twente in Enschede in the Netherlands.

The purpose of my thesis is to design an Innovation Process Model to create and identify new opportunities which in the end should result in new business. By using my own Innovation Process Model I tracked down new opportunities for sodium chloride. The pure form of Sanal Salt is very useful for the metallurgy and automotive industry.

It has come to my attention that the company, NAME COMPANY is a manufacturer of pistons for the automotive and engine industry. Pistons often have an internal lubrication and cooling system. Sodium chloride rings are needed for the casting process of this internal system. Sodium chloride pistons rings of Sanal Salt result in less negative side effects in the removal phase of the sodium chloride (NaCl) and the sodium silicate itself from the cavity in the piston.

Knowing that the cost of a single defective component is far higher in the casting part of the process because of e.g. material cost, casting processing costs, energy used and the cost of all preceding processing steps, than in the first stages of production of the ring, the lower the defective figure in the casting process is most probably by far most important from an economical point of view. The purity of Sanal Salt supports a successful casting process.

Recently, a company producing pistons for the automotive and engine industry has the intention to use Sanal P from AkzoNobel Mariager in their piston production process as a replacement for the currently used sodium chloride.

Questions from me to you are the following:

1. Is the company using sodium chloride piston rings for the manufacturing of pistons?
2. What are the demands that your company has for using sodium chloride in the production process of pistons?
3. Who is your current sodium chloride supplier?
4. What are the general costs of the use of sodium chloride in the production process, perhaps due to confidentiality reasons a percentage can be given?
5. What amount of sodium chloride is used in the production process of pistons in a monthly or yearly basis?
6. What are general problems for the company when sodium chloride is used for the production of pistons?
7. How does the organization benefit from a better quality of sodium chloride in the casting process? Energy costs, production costs, waste costs?
8. How is the overall market of the industry?

The general trend of piston production is that diesel engines use internal cooling; this trend is also the case for future gasoline engines. The volume of engines becomes smaller due to economical and environmental global reasons. This means that the temperature and pressure of engines becomes higher in engines, hence internal cooling becomes even more important. Smaller engines are less heavy and that translates into more energy friendly engines.

I hope you can answer my questions above and that you might be interested in a discussion. Perhaps we can debate about this subject by telephone. If so, please let me know and I will give you a call.

Yours sincerely, Bastiaan van de Waal

P.S. (The pictures give some clarity about the topic which is addressed above)

Cross section of produced pistons using Sanal Salt



Sanal Salt Ring used in piston production



Appendix E: Fraction of Piston Manufacturers Worldwide

Piston Manufacturers in China:

1. http://www.mahle.com/MAHLE/en/Home_EN
2. <http://www.pistonpiston.com/nl/introduction.html>
3. http://nl.made-in-china.com/co_longjian/
4. http://nl.made-in-china.com/co_cqkunyuu/
5. http://nl.made-in-china.com/co_zzwx888/
6. http://nl.made-in-china.com/co_rozinautoparts/
7. http://nl.made-in-china.com/co_shanghainiuzhang/
8. http://nl.made-in-china.com/co_jcar-cnep/
9. http://nl.made-in-china.com/co_chinapartsauto/
10. <http://www.cy-parts.com/en/about.asp>
11. http://nl.made-in-china.com/co_jcar-cnep/
12. <http://www.cnflap.com/>
13. http://nl.made-in-china.com/co_cncaiecq/
14. <http://www.toso.cn/>
15. <http://www.tianhongjix.com/index.html>
16. <http://www.catic.cn/indexPortal/home/index.do?cmd=goToChannel&cid=688>
17. <http://jinan-dianshe.en.ywsp.com/contact/>
18. http://user.china-forge.net/stencil/1/list_en.asp?Client_ID=187&Edition_ID=2&mid=6336
19. <http://www.fangchangmold.com/en/contact.asp>
20. <http://www.tikparts.com/aboutus.php>
21. http://www.wo-tech.com.cn/index_gocontactus.action
22. http://www.goldtruth.com.cn/contact_service_en.asp
23. <http://www.youfu-forging.com/CONTACT/>
24. <http://www.made-in-china.com/showroom/longdamechanicalpart>
25. <http://www.forgingcasting.com/cont.asp>
26. http://www.nbxus.com/en_lianxi.asp
27. <http://www.castleintl.com/contact.asp>
28. <http://www.albama.biz/en/Index.html>
29. <http://qixia-yinyun.en.ywsp.com/contact/>
30. <http://www.dwitparts.com/contact.asp>
31. http://www.china-casting.com/en/Contact_us.asp
32. <http://wfgangtao.com/>
33. <http://oceanindustryhz.en.made-in-china.com/>

Piston Manufacturers in Taiwan and South Korea:

1. <http://www.challengehardware.com.tw/about.htm>
2. <http://www.engimax.url.tw/Private/manage.htm>
3. <http://www.clizen.com/customer-support-contacts>
4. http://www.bat31.com/sub4_1_e.html

Piston Manufacturers in India

1. <http://www.made-from-india.com/showroom/shriramintl/gallery.html>
2. <http://www.jaicylindrliners.com/>
3. <http://www.meenacast.com/contact.html>
4. <http://www.tandemhydraulics.com/profile.html>
5. <http://www.shivamhydraulics.com/aboutus.html>
6. <http://www.made-from-india.com/showroom/leon-impex/contact.html>
7. <http://www.made-from-india.com/showroom/monil-cast/>
8. http://www.made-from-india.com/showroom/Perfect-Exports/products/Engine%20Pistons_6060.html

Piston manufacturers in Turkey

1. http://www.lepar.com.tr/eng/profil_eng.asp
2. <http://www.mogesan.com/web/eng/contact/default.asp>
3. <http://www.meplinpiston.com/EN/iletisim.asp>
4. <http://www.otocelik.com/Turkce/>
5. <http://www.gemmaautomotive.com/eng/contact>
6. <http://www.sampa.com.tr/index.php?id=610000&dil=EN>
7. <http://www.delkom.com.tr/contact.html>
8. <http://makrotekdenizcilik-4439030.en.gongchang.com/contact>
9. <http://www.genpamotor.com/>
10. <http://www.deltaotomotiv.com/en/index.asp?sayfa=ICERIKDETAY&IID=9&sayfaadi=İLETİŞİM>

Piston manufacturers in elsewhere:

1. http://www.wiseco-europe.com/gen_info.htm
2. <http://www.scania.com/products-services/engines/industrial-engines/index.aspx>
3. <http://www.jepistons.com/AboutUs.aspx>
4. <http://www.arias Pistons.com/custompistons.html>
5. <http://www.spk.co.jp/english/products/index.html>
6. <http://www.teikin.com/>